NOVEMBER
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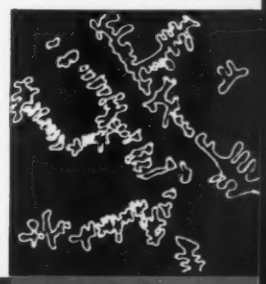
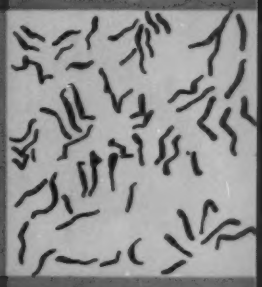
FOUNDRY

A PENTON PUBLICATION





SOLIDIFICATION STRUCTURE, AND PROPERTIES OF..

GRAY IRON

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■ Shell Molding for Steel Castings p. 88

■ Standards Needed for Surface Finish p. 93

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. . . If you have a Simpson Mix-Muller,

you have a head start for the

***progressive* mechanization of your sand system.**

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How to control casting quality:

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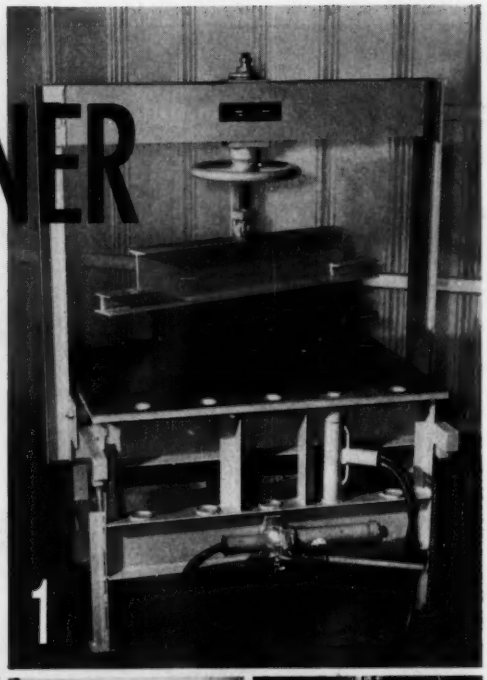
WORKS 6 WAYS to make foundry flasks accurate—and serviceable longer!



1 **CHECKS AND CORRECTS SAND JOINTS** . . . Accurately machined surface plate shows inaccuracies in sand joints on cope and drag. Eliminates costly machining and eventual scrapping of flasks.

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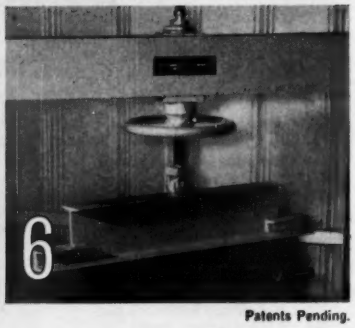

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November 1961
Volume 89—Number 11

FOUNDRY
A PENTON PUBLICATION

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FOUNDRY is edited primarily for management, production, technical, and purchasing personnel in foundries. A copy is sent at no cost to each metal casting plant in the U. S. and Canada employing 20 or more workers and to selected smaller foundries. Additional copies are sent to each foundry to the extent necessary to serve all key foundry personnel on a personal or routed basis. A limited number of copies is supplied at no cost to educational institutions. Subscriptions in the U. S., possessions, and Canada for home-addressed copies and copies not qualified for under the above principles: One year, $10. Single copy, $1. Other countries: One year, $20. Single copy, $2. Published monthly by the Penton Publishing Co., Penton Building, Cleveland 13, Ohio. Accepted as controlled circulation publication at Cleveland, Ohio.

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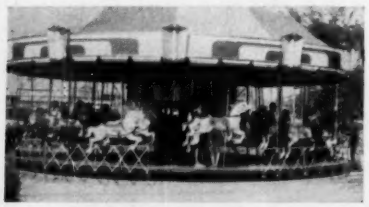
THE EDITORS' WORKSHOP

CHILL TEST: Accurate determination of the chilling potential of base iron and the nucleating power of inoculants at fairly high rates of solidification is important in preventing chilled edges on castings. The advantage of a relatively thin chill test in making these chill depth measurements was demonstrated in a recent investigation. This study was conducted to determine the influence of chill test thickness on the depth of chill obtained on gray iron with different inoculation treatments. A report of the findings will be presented next month.

MERRY-GO-ROUND: What happens when a foundryman changes from bentonite-bonded sand mixtures to fire clay-bonded sands in mechanized molding systems? In



the December issue, Clyde A. Sanders, American Colloid Co., describes 20 sequential occurrences resulting from the bonding clay change made because "the molding sands are drying out." Step 20 brings the foundman right back where he started. The moral is—avoid hot sand and keep off the merry-go-round.

COMING UP: Other articles scheduled for coming months will provide a variety of topics. Some of the subjects to be discussed include the following: Metallurgical control in the nonferrous foundry; production and use of resin-coated sand; a new development in sand control; production of complex aluminum castings; problems in making large cast steel gears; design and production of manganese bronze castings; how to correct elevator belt problems; preheating cupola blast air; pinhole porosity in gray iron; solving a shrinkage problem; specifications for gray iron castings.

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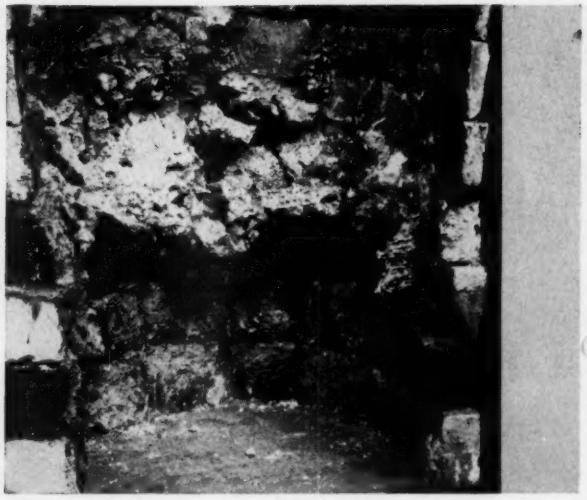
COKE — COAL — COAL CHEMICALS

Cost-reducing Facts for Foundrymen:



Here's the inside story on are reduced, production is

A FEW BASIC FACTS

Erosion of the lining, coke ash, and adhering sand on returned scrap are sources of the slag obtained in the acid-line cupola. These materials are primarily silica or SiO_2 (silicon dioxide), that, even with considerable impurities present, have a relatively high melting point . . . possibly exceeding temperatures of 2900° F. Pure SiO_2 does not fuse until the temperature reaches approximately 3100° F.

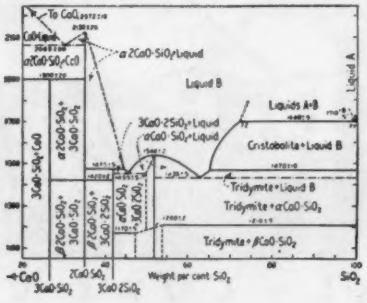
How to remove slag

Undesirable slag constituents must be transformed into a liquid that will flow readily at normal operating cupola temperatures below the melting zone or at temperatures exceeding 2400° F.

One "recipe" that attempts this is the addition of limestone to the cupola. As the limestone drops into portions of the cupola where temperatures rise over 1650° F., it is calcined to lime or CaO with considerable loss of heat. It is hoped that lime so formed will combine with the SiO_2 and form a lower melting temperature slag. (See Fig. 279. The melting temperature of the slag decreases to a low of about 2610° F. with increasing additions of CaO up to 35 mol %.)

This temperature is not very low for cupola operation. Also, conditions frequently occur that prevent

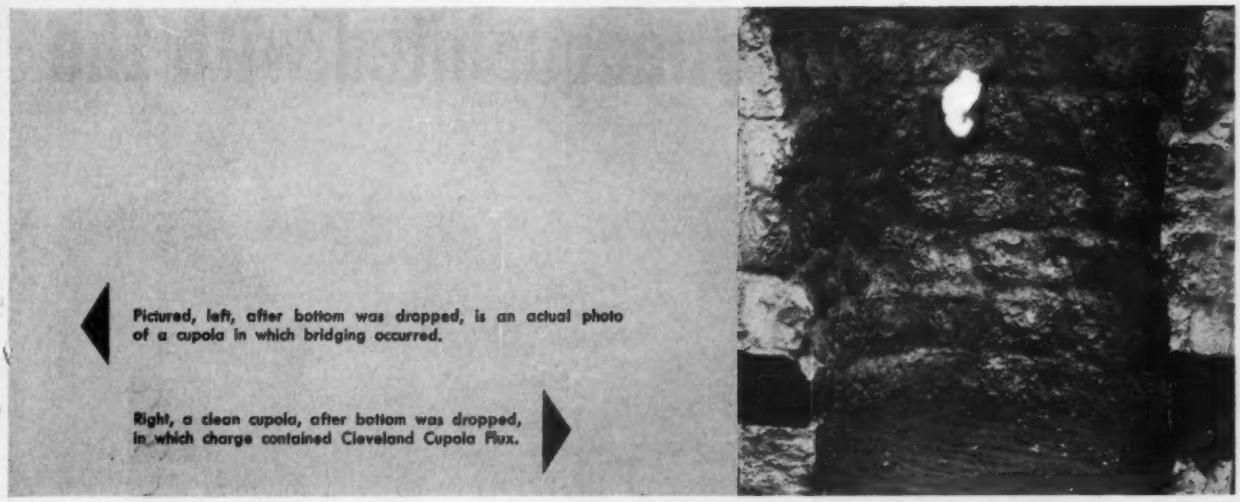
Fig. 279 — Equilibrium diagram for CaO-SiO_2 system (Hall and Insley, *Journal of American Ceramic Soc.*)



the melting point of the slag from approaching that temperature. Failure to reach and maintain this temperature results in insufficient slag fluidity. It becomes viscous or pasty and chokes up the intensity of the coke . . . and in the areas chilled by the tuyeres, BUILDS A BRIDGE.

Three factors cause bridging

(1) High silica content in localized areas because of lining erosion or charge variations producing a higher slag melting temperature (2) Cold spots in cupola due to variations in charge concentration (3) Low temperature areas in the cupola caused by channeling of air through the charge and a non-uniform oxidation zone across the cupola.



Pictured, left, after bottom was dropped, is an actual photo of a cupola in which bridging occurred.

Right, a clean cupola, after bottom was dropped, in which charge contained Cleveland Cupola Flux.

9633-CF

how bridges in cupola operation increased...time and money saved

HOW TO CURE BRIDGING

Cleveland Cupola Flux avoids bridging problems by lowering the fusion point of the slag. Used regularly in the charge in the prescribed amounts—one full brick for each ton of metal charged—melting point and viscosity of the slag are lowered sufficiently to avoid bridging difficulties, even in high silica and low temperature areas.

Ingredients of Cleveland Cupola Flux are prepared and balanced to accomplish this without stack losses or high basic concentrations that attack the acid lining. Melting point of the slag is lowered hundreds of degrees so that it flows rather than sticks. The charge flows uniformly and is kept under proper control, resulting in balanced behavior.

These same ingredients are balanced to provide both the lower fusion temperature with fluorspar (CaF_2) and lime or CaO obtained from limestone. Fig. 713 shows the effect of fluorspar on the melting temperature of lime. Fig. 690 shows its effect on the slag melting temperature from a combination of SiO_2, CaO and CaF_2.

Serious bridging can stop all downward flow of the charge and force the operator to drop bottom! Slight bridging can cause irregular rates of fall of the charge in the cupola! Bring channelling of the gas and erratic operation!

Cleveland Cupola Flux reduces or eliminates bridging, helps increase production . . . saves you time and money! For more information on this or other fluxing operations, send your inquiries to our new Technical Service Department at the address below.

Fig. 713— System CaF_2—CaO. B. Karandyeev, *Z. anorg. Chem.*, 68.

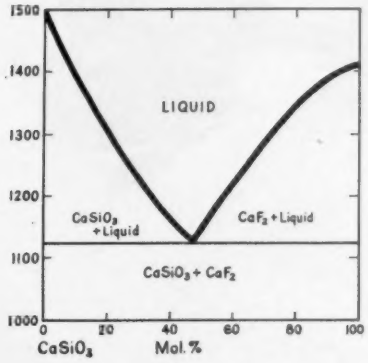
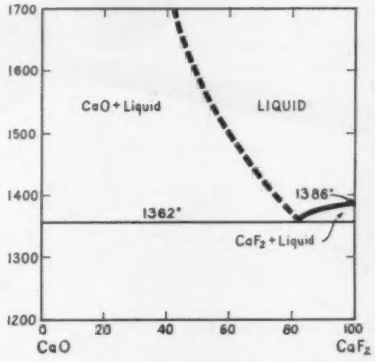


Fig. 690—System CaF_2—CaO. W. Eitel, *Zement*, 27, 455-59, 469-72, (1938).



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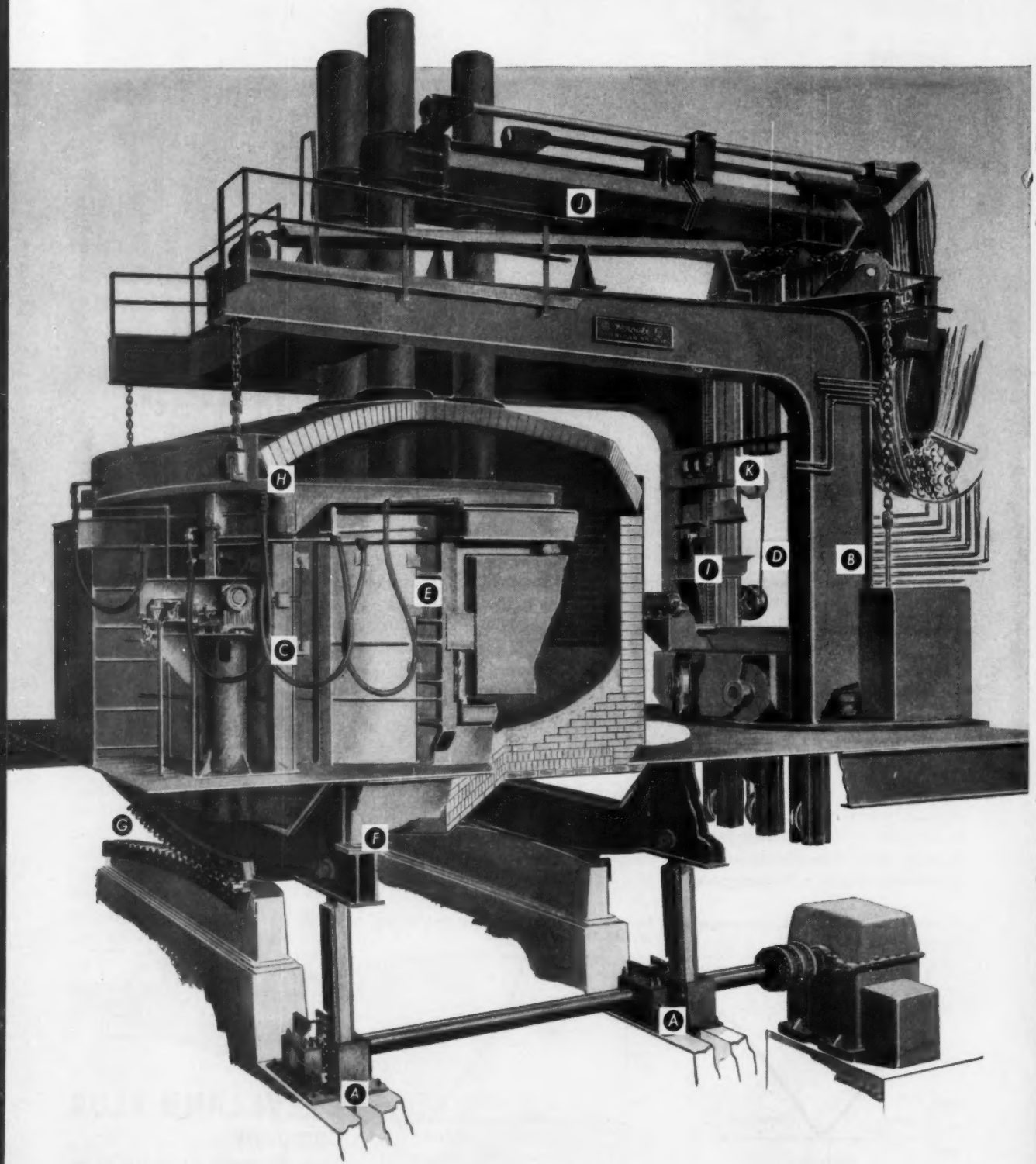

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2. Cage-type shell construction with shell plates loosely attached **(E)** to heavy supporting structure. This construction minimizes shell warping and allows easy replacement of damaged shell plates.

3. Operating mechanism independently supported. The tilting platform on which all operating mechanisms are supported is attached directly to the rockers independent of the shell structure **(F)**. Thus, operating mechanisms are unaffected by shell distortion.

4. Water-cooled, Skew Back Roof ring. This feature **(H)** eliminates the need for special skew-shaped roof refractories.

5. Electrode Mast Safety Device. This spring-loaded, rack-and-pawl-type device **(I)** provides positive protection against damage resulting from electrode winch cable breakage.

6. Square-section, Water-Cooled Electrode Mast Arms. This design **(J)** guarantees a rigid connection between mast and mast arm, thus helping to maintain proper electrode position.

7. Remote-Controlled Electrode Clamps. This device, of the spring-clamp, air-release type, is located inside of the rear section of the water-cooled mast arm where heat cannot affect it.

8. Square-Sectioned Electrode Mast. This design feature **(K)**, developed by American Bridge, assures proper guiding and electrode positioning.

9. Rockers. The heavy fabricated steel curved top and bottom rockers **(G)** minimize forward travel during tilting. These rockers are designed so that the furnace will tend to return to horizontal position from any degree of tilt.

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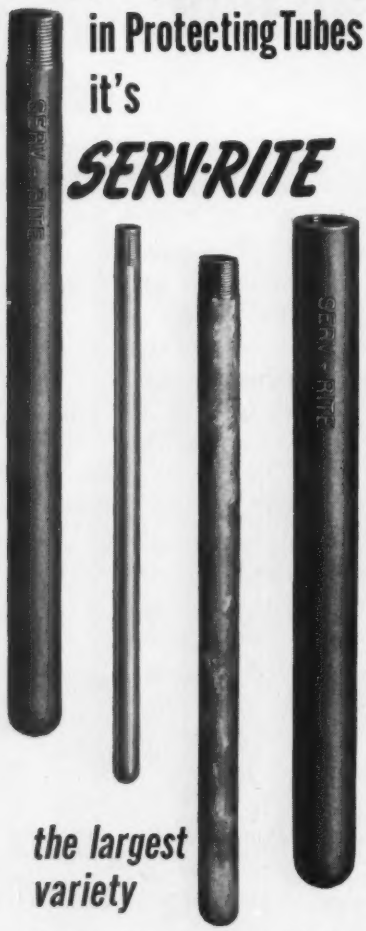

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With the EDITORS

Diecasting Judges: Editor Bill Gude was one of the judges for the recent "Zinc Diecasting of the Year" sponsored by the New Jersey Zinc Co., New York. The three

judges, from left to right—Editor Gude of FOUNDRY, George C. Nordenholt, formerly chief editor, *Product Engineering*, and Burnham Finney, editor of *American Machinist/Metalworking Manufacturer*—are shown in the illustration examining the tiny counter assembly which won the prize (see page 143).

Rare Beauty: Interesting colored photographs of beautiful cast bronzes from the Shang Dynasty of ancient China (roughly 1700 to 1100 B.C.) are reproduced in the Sept. 29 issue of *Life*. It seems incredible that this ancient civilization would have the artistic skill and the craft ability to produce bronzes with such excellent reproduction of fine detail.

Objects shown include a memorial bronze mask, bronze container for wine, bronze iron for ritual cooking, bronze dragons for chariot decoration, and a section of the art work on a bronze cauldron.

Under a heading "Rare Bronze Beauty," the magazine comments as follows: "The Shang civilization reached its cultural peak in the flourishing foundries where master craftsmen cast bronze into enduring works of art. Ushering the Bronze Age to China, they produced a huge array of weapons and secular objects, but their crowning achievements were enormously elaborate ritual vessels. The Shang used these to propitiate their ancestors with gifts of meat, grain and wine.

"The highly ornamented surfaces preserve a wide-ranging zoo of real and imaginary animals, including the ubiquitous Chinese dragon. Sometimes they are rendered naturally but more often in a markedly stylized design which combines elements of varied beasts. The vessels came in such a rich profusion of shapes and sizes that, of hundreds which have been reclaimed from China's soil, no two are exactly alike."

Donaldson in Europe: As this is written, F. Kermit Donaldson, executive vice president, Steel Founders' Society of America, and recently elected president of the American Society of Association Executives (FOUNDRY for October, page 214), is heading a delegation of association executives visiting four European countries on an International Study Mission. The mission convened in London on Oct. 13.

On Oct. 11, Kermit addressed the annual meeting of the British Steel Founders' Association at the Gleneagles Hotel, Perthshire, Scotland.

Herrmann at Kokomo: Editors do get around. The illustration shows FOUNDRY's Associate Editor Bob Herrmann (right) and *Iron Age's* Engineering Editor R. H.

Eshelman listening to H. E. Eriksen, plant manager of Chrysler's die casting plant in Kokomo, Ind., tell about some of the 53 products made there. Bob's story on the diecasting

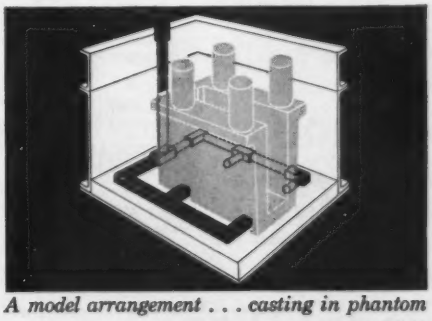
REFRACTORY GATE AND RUNNER TILE

AVAILABLE IN ROUND OR SQUARE SHAPES

Harbison-Walker Gate and Runner Tile are strong and withstand rapid metal flow without excessive erosion, assuring cleaner castings. Tile of minimum diameters may be used, with considerable reduction of metal in the gates, and consequent savings in scrap loss. Being much stronger than sand, the refractory tile permit pouring under high pressure, thereby reducing gas inclusions. • Installation in the mold is easier and faster, and overall cost is less. And the excellent workmanship of H-W Gate and Runner Tile accounts for their good tight fit. • More than 200 sizes and shapes are available, including cups or funnels, round and square tile with plain or jointed ends, crosses, tees and ells for complete gating systems. Many of the more popular sizes are available from stock. Write for catalog. • Harbison-Walker supplies refractories for other pouring equipment, including sleeves, nozzles and monolithic linings for foundry ladles.

Shapes for every need

Tight-fitting joints



A model arrangement . . . casting in phantom

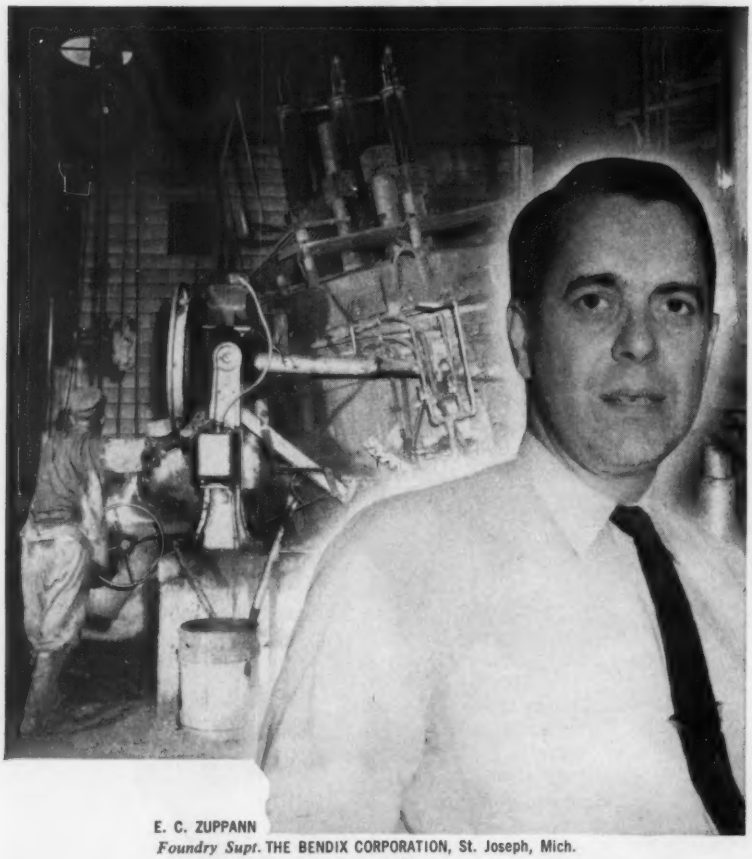
HW 61-20

HARBISON-WALKER REFRACTORIES CO.

AND SUBSIDIARIES • GENERAL OFFICES: PITTSBURGH 22, PENNSYLVANIA

World's Most Complete Refractories Service

For More Information Circle 565, Page 39



E. C. ZUPPANN
Foundry Supt. THE BENDIX CORPORATION, St. Joseph, Mich.

"We have found 10-pound Spiegel foundry pigs to be the most economical form in which to buy our manganese."

And a great many other progressive foundries throughout the country also are discovering the economies in this unique iron-manganese alloy for their manganese additions.

It will pay you to investigate 10-pound Spiegel Foundry Pigs. Compare the cost with that of your present source of manganese.

We will be glad to help you with your calculations.

Ask for the folder "This is Spiegeleisen".

10-pound SPIEGEL
IRON-MANGANESE ALLOY
Foundry Pigs

Distributed by

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ORE & FERRO CORPORATION
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THE NEW JERSEY ZINC COMPANY
160 Front St., New York 38, N.Y. • 221 No. LaSalle St., Chicago 1, Ill.

of V-6 aluminum blocks for Valiants and Lancers at that plant was in FOUNDRY for October, p. 165.

Talk About Marketing: A foundry marketing conference (page 172) staged in Cleveland Sept. 12 under the joint sponsorship of International Minerals & Chemical Corp. and Hickman, Williams & Co., drew praise from the Northeastern Ohio,

and Northwestern Pennsylvania foundrymen in attendance. The illustration shows a part of the welcoming group which included, left to right, Norman J. Dunbeck, vice president, International Minerals & Chemical Corp., J. M. Stewart and John H. Tressler, vice presidents, Hickman, Williams & Co.

Shades of Bill! The fact was reported on this page in the August issue that Harry L. Richey, for 35 years the artist for the "Adventures of Bill" series, had retired from the

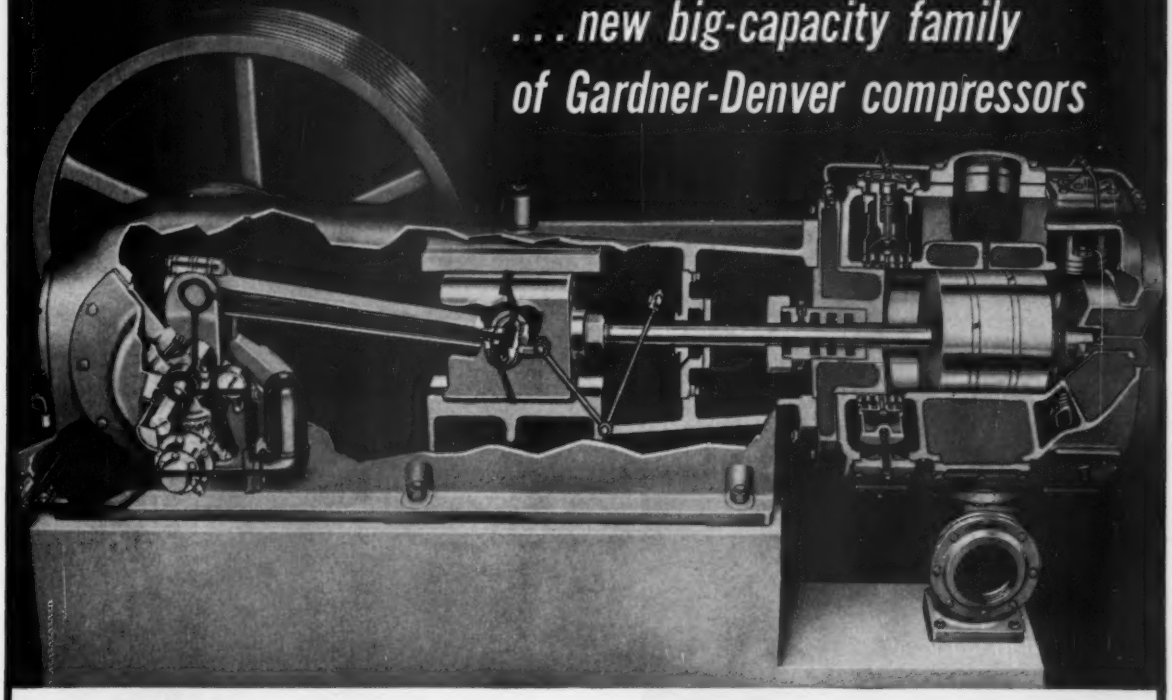
Penton company and had moved to Florida. Harry now reports that he is becoming acclimated to the life of leisure, and, as may be noted in the accompanying illustration, has adopted shorts, the badge of retirement in the Sunshine State.

Harry, this department will be happy to have additional cartoons if and when the spirits move you.

F.G.S.

MORE AIR POWER PER SQUARE FOOT OF FLOOR SPACE

. . . new big-capacity family of Gardner-Denver compressors



Pressure lubrication

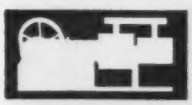
New pressure system thoroughly lubricates bearings and moving parts in power end. System includes extra capacity oil sump, strainer, oil pump, oil filter and oil passages to all bearings.

Greater cooling capacity

Large water passages through the cylinder head and jacket efficiently cool the greater volume of compressed air delivered by Gardner-Denver RL compressors.

Four basic sizes with 5″, 7″, 9″ and 11″ stroke power frames, fill a wide range of capacity and pressure requirements... from 20 to 150 hp. All compressor sizes are available with oil-free construction.

Single stage RL horizontal models displace 108 to 1592 cfm, with pressures ranging from 20 to 150 psi.



RLT two-stage tandem compressors provide higher pressures up to 500 psi, with displacements ranging from 94 to 504 cfm.

RLV vacuum pumps give from 267 to 1383 cfm displacement; provide vacuum service to 29.8 in. Hg.

***New bulletins** describe in detail this fine new family of big-capacity Gardner-Denver RL compressors. Write for your copies now.*

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

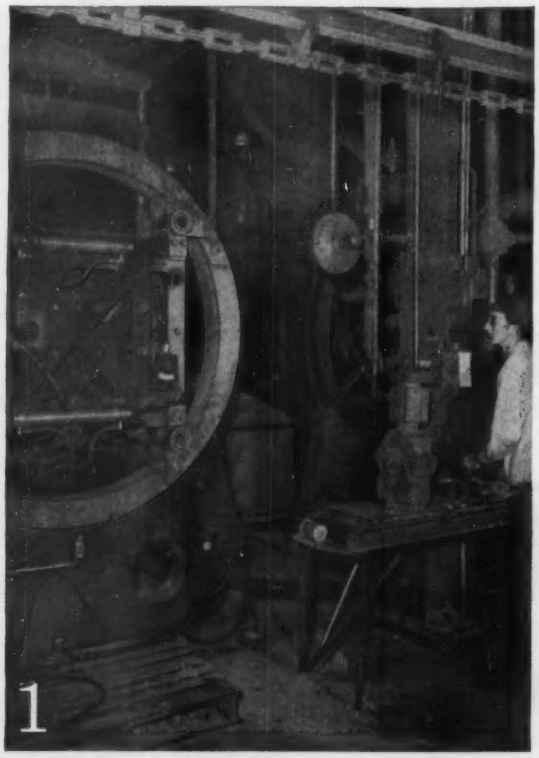
Gardner-Denver Company, Quincy, Ill.—Offices in principal U.S., Canadian and Mexican cities
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Ave., Toronto 16, Ontario
International: Gardner-Denver International Division, 233 Broadway, New York 7, N.Y.
Offices: Buenos Aires, Argentina; Artarmon, N.S.W., Australia; Brussels, Belgium; Rio de Janeiro, Brazil; Santiago, Chile; Barranquilla, Colombia; Lima, Peru; Ndola, N. Rhodesia; Salisbury, S. Rhodesia; Johannesburg, Transvaal.

For More Information Circle 567, Page 39

John Deere Reports on Shalco Shell Core Blowing . . .

One piece, completely hollow precision shell cores cut cost of heavy castings

At the John Deere Tractor Works, Waterloo, Iowa, two Shalco U-360 Shell Core Blowing Machines have slashed production costs of large heavy castings for John Deere "New Generation" Tractors. In the photos, follow the production of Shalco one piece, completely hollow precision shell cores—in sections, over 1" thick! See how they help this famous farm implement manufacturer produce heavy engine block castings . . . faster, more economically. Then, consider this: John Deere's experience is typical. The economical production of large precision cores for heavy duty castings is duck soup for Shalco U-360's. Everywhere, cost-conscious foundrymen are taking advantage of this unique capability and the unmatched service and engineering experience that backs it up. You'll profit by getting complete details. Call, write or wire.



More core production with less manpower —The two Shalco U-360's produce up to 120 precision shell cores per hour (1). With conventional methods, equal output required twice as much manpower! Completed cores are exceptionally strong, but lightweight and easy to handle (2).

Less core processing and handling expense, less cleaning, less material—Shalco one-piece cores have eliminated costly, time-consuming "halving", Result—no core drying, and baking, a reduced requirement for production floor space, less handling, no seam finishing. Shalco cores are amazingly smooth and accurate . . . are completely hollow and at least 33% lighter than solid cores. (To meet John Deere's unusually high specifications, critical areas of these particular cores are sprayed to further assure highest casting quality and strength.)

Last phase of Shalco savings . . . highest quality castings . . . for less—Six Shalco cores (one per engine cylinder) are assembled and the mold is ready for pouring (4). No chance of misalignment here. The Shalco Shell Core Blowing Machines produce identical, precision cores that fit together quickly, easily . . . every time.

Removed from the mold, the rough casting is ready for shakeout (5). Thanks to the excellent collapsability of Shalco Shell Cores, shakeout is complete and there's little need for cleaning.

And here's the completed casting (6). Due to the precision and consistency of Shalco Shell Cores, the casting has no sand inclusions. This cuts cleaning time from hours to minutes and greatly reduces finish machining. Less casting stock is wasted, the life of finishing tools is extended . . . and further savings are realized through an additional reduction in manpower.

SHALCO DIVISION OF
National Acme
THE NATIONAL ACME COMPANY
173 E. 131st STREET
CLEVELAND 8, OHIO

Sales Offices: Newark 2, New Jersey, Chicago 6, Illinois, Detroit 27, Michigan
Licensee in the United Kingdom: Stone-Wallwork, Limited, London SW-1 England

Carbon/Graphite Facts for FOUNDRIES

NATIONAL TRADE MARK

CUPOLA LININGS

MORE and more foundries are reducing refractory costs by specifying chemically-neutral, high-strength cupola linings of NATIONAL carbon. This unique material has no melting point, resists acid or basic slag, and is not wet by molten iron. It not only withstands severe thermal shock, but has high strength at elevated temperatures. Carbon linings permit cupola operation for extended periods, resulting in more production and less maintenance cost.

Circle No. 553 on Page 39

CARBON PASTE

"NATIONAL" carbon paste is an important contributor to the long service life and economy of carbon block or brick cupola linings. The lining can be readily patched with small amounts of this thermic ramming paste. The paste as supplied is hard at room temperature. After proper heating it is merely tamped into place. The patch is cured by the heat of cupola operation.

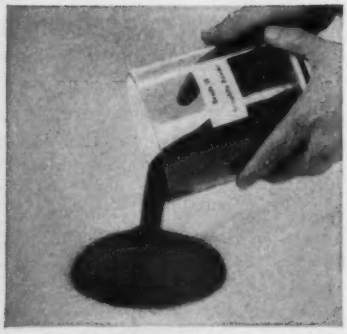
Circle No. 554 on Page 39

GRAPHITE PLUNGING BELLS

DEEP immersion, uniform dispersion, and high recovery of alloying agents in making ductile iron are possible through the use of NATIONAL graphite plunging bells and sleeves. Resistance to thermal shock extremes, immunity to distortion and spalling, as well as non-wetting characteristics, insure uninterrupted and accurately controlled service of foundry products designed specifically for this purpose. Standard sizes are available from stock, although special sizes can be made to order.

Circle No. 555 on Page 39

GRAPHITE POWDERS



NATIONAL graphite powders—ranging in size from very fine flour to coarse particles—are available for a wide variety of applications. Fineness and maximum ash content are held within closely controlled limits. A few uses include: injection or inoculation of ferrous metals, mold washes, powder glazing, lubricants, and powder metallurgy applications. For complete list and specifications, request Catalog Section S-7655.

Circle No. 556 on Page 39

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NATIONAL CARBON COMPANY
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IN CANADA: Union Carbide Canada Limited, Toronto

UNION CARBIDE

LATE NEWS

FOUNDRY OUTLOOK: In a recent survey of its members by the Steel Founders' Society of America, 73 per cent of the respondents expected steel casting shipments to increase an average of 18 per cent in the last half of 1961.

In the latest of its monthly surveys, Gray Iron Founders' Society reports that 183 gray iron foundries operated at 66 per cent of "ideal" capacity during September. Not much change was seen for October.

As reported last month, both Non-Ferrous Founders' Society and American Die Casting Institute members foresee increased shipments.

ORDNANCE CONTRACT: Central Foundry Div., General Motors Corp., Saginaw, Mich., has been awarded a research and development contract by the Army Ordnance Corps, Detroit Ordnance District, for production engineering of a new-type 105-mm HE projectile, the main body of which will be cast in pearlitic malleable iron.

GIFS ELECTS: Cecil R. Garland, W. O. Larson Foundry Co., Grafton, Ohio, was named president of the Gray Iron Founders' Society at its annual meeting Oct. 18-20 in Toronto. Other officers include J. W. Simmons Jr., Cox Foundry & Machine Co., Atlanta, vice president; R. E. Crowe, Crowe Foundry Ltd., Hespeler, Ont., Canada, secretary; Paul H. Scherf, Alten Foundry & Machine Works Inc., Lancaster, Ohio, treasurer; and William F. Seelbach, Forest City Foundries Co., Cleveland, assistant treasurer.

New directors elected for a three-year term

Foundry Statistics

Iron and Steel Scrap Consumption

(Gross tons[a])

	All Scrap Total	By Types of Furnace — Cupola Total	Air Total	Electric Total
1959	58,979,881	9,613,050	1,156,097	9,232,037
1960				
July	3,678,127	503,082	55,974	520,361
7 mo. ..	38,953,209	5,423,579	605,275	5,637,360
Aug.	4,217,562	692,470	78,788	697,243
Sept.	4,148,550	732,252	76,939	641,712
Oct.	4,375,871	742,039	71,862	675,356
Nov.	3,939,970	709,187	70,282	607,471
Dec.	3,738,385	669,250	66,438	601,274
Total ...	59,387,010	8,968,777	989,584	8,850,396
1961				
Jan.	4,059,361	654,353	65,434	646,999
Feb.	3,925,802	593,810	61,286	642,853
Mar.	4,449,078	677,617	73,544	710,749
Apr.	4,665,842	675,271	70,073	725,994
May	5,333,515	757,033	82,093	837,312
June	4,937,183	773,545	80,786	797,618
July	4,295,665	539,469	50,814	630,785
7 mo. ..	31,666,446	4,671,098	484,030	4,892,310

Index of Foundry Equipment Orders

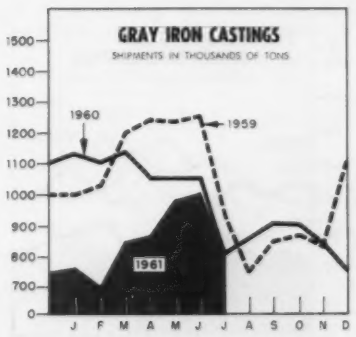
Foundry Trades Only

(Net Orders Closed, New Equipment)

	1960	1961
Jan.	95.5	123.7
Feb.	128.6	81.8
Mar.	159.9	99.1
Apr.	97.9	115.2
May	159.0	101.5
June	164.3	130.8
July	80.0	69.0
Aug.	92.4	62.0
Sept.	158.1	....
Oct.	81.7	....
Nov.	106.5	....
Dec.	101.2	....

Note: Base period 1947-49 taken as 100 per cent monthly average.

Source: Foundry Equipment Manufacturers Association.



GRAY IRON CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings — Total	All Castings — For Sale	Miscellaneous Castings Total	Castings For Sale	Nodular Iron Castings Total	Heavy Steel Ingot Molds Total	Chilled Railroad Car Wheels Total	Pressure Pipe & Fittings Total[2]	Soil Pipe & Fittings Total[2]	Unfilled Orders[3]
1959	12,307,798	6,994,200	7,451,952	3,247,389	173,433	2,142,498	309,915	1,440,883	862,547	.....
1960										
July	803,306	450,580	478,269	202,347	10,694	120,784	16,226	120,652	67,375	754,789
7 mo. ...	7,344,842	3,985,689	4,365,957	1,833,209	102,548	518,876	138,907	767,017	454,085	.....
Aug.	858,503	540,395	490,059	238,561	15,675	131,428	14,221	139,275	83,520	712,784
Sept.	900,497	527,227	554,788	245,887	14,616	125,688	13,460	135,327	71,234	695,325
Oct.	905,139	500,054	568,869	238,249	12,859	139,977	12,559	117,009	66,725	646,852
Nov.	835,709	454,611	538,817	230,022	11,870	123,054	12,410	102,959	58,469	568,974
Dec.	748,821	394,981	506,979	219,525	12,097	107,559	12,306	73,959	48,018	552,813
Totals ..	11,593,511	6,402,957	7,025,469	3,055,453	169,854[4]	2,246,582	203,863	1,335,546	782,051	.....
1961										
Jan.	760,136	406,315	504,182	222,508	11,874	123,277	11,847	69,881	50,949	599,776
Feb.	702,413	378,252	465,654	209,207	11,184	116,563	7,403	66,541	46,252	620,623
Mar.	856,491	406,928	509,932	232,384	12,193	155,545	9,090	110,792	71,132	651,696
Apr.	869,233	503,634	515,664	225,966	15,910	148,899	9,208	121,867	73,595	645,412
May	982,319	571,995	557,246	237,965	16,155	191,679	11,911	139,971	82,412	650,582
June	1,027,212	606,283	580,234	250,291	15,390	201,644	8,921	151,212	85,201	666,487
July	804,200	474,114	421,169	184,173	12,591	179,826	7,825	124,758	70,622	673,776
7 mo. ...	6,002,004	3,437,521	3,354,081	1,562,394	95,297	1,117,433	65,305	785,022	430,163	.....

Source: U. S. Dept. of Interior, Bureau of Mines. [1]Source Bureau of the Census. [2]For sale only. [3]All cast iron pipe is shipped for sale. [4]Gray iron total includes nodular iron. [5]Monthly figures do not add up to total shown because of unreported monthly revisions.

Late News

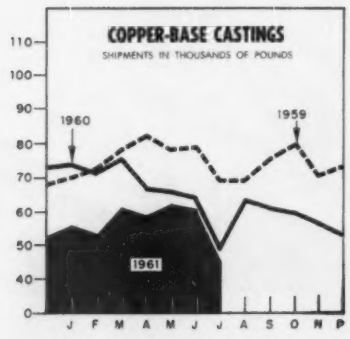
are William Z. Taylor, Taylor & Co., Brooklyn, N. Y.; C. A. Glenn, Lynchburg Foundry Co., Lynchburg, Va.; Carl W. Mueller, Universal Foundry Co., Oshkosh, Wis.; and D. L. Robertson, Apex Steel Corp., Los Angeles. D. H. Workman was reappointed executive vice president.

GIFS AWARDS: Henton Morrogh, director, British Cast Iron Research Association, received the Gold Medal of the Gray Iron Founders' Society at the group's recent annual meeting. The award was made for Mr. Morrogh's outstanding contributions to the fundamental knowledge of cast iron metallurgy. Citations in the form of illuminated scrolls were presented to John E. McIntryre, Sibley Machine & Foundry Corp., South Bend, Ind., outgoing GIFS president, and to James Crowley, Pioneer Foundry Co., Jackson, Mich., for their service to the society and to the industry.

BUSINESS INDICATORS: September net orders for metal-cutting type machine tools totaled $56,750,000, the highest monthly figure since 1957, according to the National Machine Tool Builders' Association. The 1961 third-quarter total was $148,250,000, the best since the first quarter of 1957 . . . Bookings of industrial material handling equipment manufacturers in August dropped 17 points below the July level, to 113.28 on the Material Handling Institute Inc. index, which uses 100 as the monthly average for the base year 1954 . . . Net new orders for industrial heating equipment in September totaled $3,915,000, a decline of 32 per cent from the August volume. During the first nine months of 1961, net new orders declined 8 per cent from 1960, although foreign orders increased 89 per cent . . . Deliveries of new freight cars came to 2700 in September, compared with 2428 in August and with 4300 in September, 1960. September new orders rose from 1474 in August to 3143 in September.

FEMA OFFICERS: R. A. Brackett, Spencer Turbine Co., was elected president of the Foundry Equipment Manufacturers Association at its recent annual meeting. He succeeds E. A. Borch, National Metal Abrasive Co. Other new officers: First vice president, C. G. Hawley, Jeffrey Mfg. Co.; second vice president, R. M.

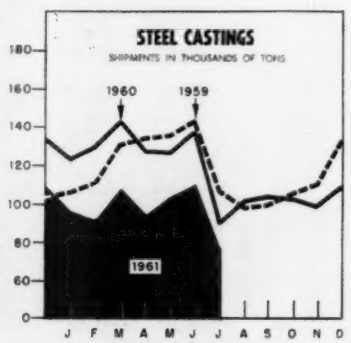
Foundry Statistics



COPPER-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments			
	Total	Sand	Perm. Mold	Unfilled Orders[2]
1959	871,032	765,246	52,456	.....
1960				
July	48,399	42,778	2,910	22,367
7 mo.	467,736	420,882	28,018	.....
Aug.	63,765	56,344	3,660	21,915
Sept.	61,362	54,104	3,699	21,063
Oct.	59,877	52,734	3,556	22,008
Nov.	56,358	50,043	3,132	21,261
Dec.	53,009	46,237	3,369	21,914
Total	762,107	670,344	45,443	.....
1961				
Jan.	55,878	48,928	3,286	22,792
Feb.	53,457	47,156	2,615	22,065
Mar.	61,252	53,277	3,414	20,965
Apr.	58,355	50,702	3,500	22,623
May	63,348	54,741	3,865	23,769
June	61,270	53,747	3,387	23,477
July	45,684	40,112	2,084	25,392
7 mo.	399,244	348,663	22,151	.....



STEEL CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings			Carbon			Alloy			
	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Unfilled Orders[2]
1959	1,412,885	1,112,668	210,984	1,043,538	814,219	194,201	369,347	308,449	16,783	.....
1960										
July	89,565	67,294	13,430	63,753	47,570	12,804	25,812	19,724	626	223,880
7 mo.	875,818	669,845	144,803	647,007	490,763	145,686	228,881	179,082	9,117	.....
Aug.	101,709	77,146	14,619	73,338	55,099	13,713	28,371	22,047	906	213,611
Sept.	104,298	79,556	14,171	74,447	56,126	13,273	29,851	23,430	898	199,413
Oct.	102,664	79,622	14,586	72,544	57,879	13,544	30,120	21,743	1,042	186,311
Nov.	99,577	78,306	15,763	69,927	56,466	14,113	29,650	21,839	1,655	174,317
Dec.	108,249	87,417	24,849	78,805	64,997	22,295	29,444	22,420	2,554	162,882
Totals	1,392,385	1,071,871	238,796	1,016,068	781,330	222,624	376,317	290,541	16,172	.....
1961										
Jan.	96,190	76,650	11,534	68,795	56,592	10,550	27,395	20,058	984	156,683
Feb.	92,602	71,907	9,128	64,849	51,209	7,818	27,753	20,698	1,310	145,024
Mar.	107,275	82,522	11,342	75,728	59,239	10,068	31,547	23,283	1,274	143,589
Apr.	93,978	71,027	5,414	65,844	49,763	4,381	28,134	21,264	1,033	147,234
May	103,205	79,485	8,966	73,860	57,246	7,950	29,345	22,239	1,016	157,354
June	109,110	84,477	11,499	76,700	60,183	9,970	32,410	24,294	1,529	151,385
July	76,886	57,445	8,192	52,559	40,102	6,816	24,327	17,343	1,376	152,108
7 mo.	679,246	523,513	66,075	478,335	374,334	57,553	200,911	149,179	8,522	.....

[1]Source: Bureau of the Census. [2]For sale only.

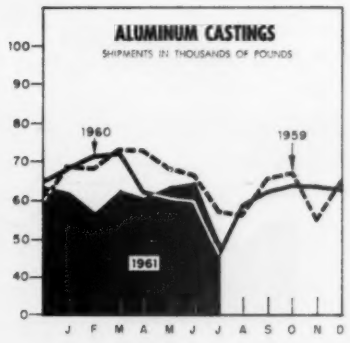
Trent, Pangborn Corp. New directors are G. O. Pfaff, Wheelabrator Corp.; G. E. Seavoy, Whiting Corp.; and D. G. Gallaher, Clearfield Machine Co.

PATTERN ASSOCIATION: A group of patternmakers met in Chicago Oct. 25 to initiate action to form a national association of patternmakers. A committee was formed to plan the organization.

PERSONALS: Wilbur M. Priester has been appointed foundry supervisor, Frick Co., Waynesboro, Pa. . . . Roger L. Hosfield has joined Hevi-Duty Electric Co., a division of Basic Products Corp., Watertown, Wis., as product manager of its oven division. He succeeds Henry Lutgen, now applications manager for large, field-erected ovens . . . Paul E. Smith, formerly chief engineer and purchasing agent, has been named vice president sales, Chase Foundry & Mfg. Co., Columbus, Ohio . . . W. Wilbur Winfree has been elected president, Glamorgan Pipe & Foundry Co., Lynchburg, Va. He formerly was senior vice president . . . James W. Volk has been named executive vice president, Brillion Iron Works Inc., Brillion, Wis.

OBITUARY: M. A. Fladoes, board chairman, Sivyer Steel Casting Co., Milwaukee, died Oct. 16 . . . J. William Mitchell, general manager, Utility Steel Foundry, Maywood, Calif., died Oct. 14 . . . George W. Effinger, 76, co-owner of a foundry supply company in Huntington Park, Calif., before his retirement, died Oct. 8 in Downey, Calif.

MISCELLANY: Larson Steel Castings Inc., Grafton, Ohio, plans to start production of steel castings in November . . . Planet Corp., Lansing, Mich., has received a $120,000 order for an automated foundry sand and flask handling system for the new Servettaz-Basevi foundry at Savona, Italy . . . Union Carbide Metals Co., a division of Union Carbide Corp., New York, has made an average increase of less than 2 cents a pound of chromium on ferrochrome alloys . . . Hansell-Elcock Co., Chicago, has been acquired by Calar Industries, Chicago. Calar has closed down operations of the foundry division, which will be sold.



PRODUCTION WORKERS

Estimated Number

	July 1961	June 1961	July 1960
Ferrous	175,300	175,800	187,100
Nonferrous	45,500	46,600	47,600

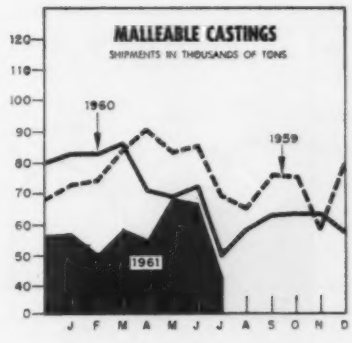
Average Weekly Earnings

Gray Iron	101.85	100.55	96.29
Malleable Iron	98.85	97.36	92.64
Steel	103.35	106.67	102.83
Nonferrous	103.57	103.97	101.81

Average Weekly Hours

Gray Iron	40.1	39.9	39.3
Malleable Iron	39.7	39.1	38.6
Steel	39.0	40.1	39.1
Nonferrous	40.3	40.3	40.4

Source: Bureau of Labor Statistics.



ALUMINUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments					Unfilled Orders[2]
	Total	Sand	Perm. Mold	Die		
1959	786,399	141,987	274,855	368,101		.....
1960						
July	45,694	8,765	15,804	20,973		76,434
7 mo.	440,051	79,078	146,609	213,590		.....
Aug.	58,848	10,639	18,901	29,256		75,230
Sept.	62,116	10,514	22,031	29,527		75,144
Oct.	63,750	10,149	23,339	30,213		71,364
Nov.	63,408	9,901	23,612	29,831		73,032
Dec.	63,629	9,578	23,272	30,677		71,398
Total	751,802	129,859	257,764	363,094		.....
1961						
Jan.	60,774	10,210	21,821	29,904		63,729
Feb.	57,144	10,183	19,518	27,355		62,748
Mar.	62,518	10,715	21,454	30,246		62,883
Apr.	60,253	10,037	21,065	29,096		65,316
May	63,299	9,945	23,484	30,167		69,110
June	64,353	10,208	24,326	29,724		68,180
July	48,652	9,814	15,902	22,830		71,527
7 mo.	416,993	71,112	147,570	199,322		.....

[1]Source: Bureau of the Census. [2]For sale only.

MALLEABLE IRON CASTINGS

(Shipments of castings—net tons[1])

	Shipments		Standard		Pearlitic		Unfilled Orders[2]
	Total	For Sale	Total	For Sale	Total	For Sale	
1959	916,362	557,303	729,868	449,946	186,494	107,357	.....
1960							
July	49,860	28,575	37,187	22,477	12,673	6,098	74,329
7 mo.	515,215	391,268	397,603	232,941	117,612	58,327	.....
Aug.	58,785	36,765	46,522	29,077	12,263	7,688	69,833
Sept.	63,048	36,114	48,635	28,623	14,413	7,491	69,033
Oct.	63,521	35,492	47,932	27,813	15,589	7,679	58,616
Nov.	62,978	35,432	47,571	27,611	15,407	7,821	55,627
Dec.	57,154	31,500	43,319	24,729	13,835	6,771	54,657
Totals	820,761	466,571	631,582	370,794	189,119	95,777	.....
1961							
Jan.	57,697	34,064	43,778	27,104	13,919	6,960	52,171
Feb.	50,828	29,675	39,358	23,854	11,470	5,821	47,708
Mar.	58,464	33,531	45,747	26,711	12,717	6,820	45,477
Apr.	55,590	31,436	43,192	25,152	12,398	6,284	48,998
May	68,406	40,270	52,637	32,197	15,769	8,073	51,894
June	67,247	40,359	51,918	32,437	15,329	7,922	51,512
July	42,066	27,115	32,180	10,466	9,886	5,401	66,473
7 mo.	400,298	236,440	308,810	177,921	91,488	47,281	.....

Prices of Foundry Metals and Coke

(As of October 26, 1961)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE

Connellsville	$18.00-18.50

OVENS

Birmingham	$30.35
Buffalo	32.00
Chattanooga	30.80
Detroit	32.00
Erie, Pa.	32.00
Indianapolis	31.25
Kearny, N. J.	31.25
Milwaukee	32.00
Neville Island (Pittsburgh)	30.75
New Haven, Conn.	31.00
Painesville, O.	32.00
Philadelphia	31.00
St. Louis	33.00
St. Paul	31.25
Swedeland, Pa.	31.00
Terre Haute, Ind.	31.25

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Birdsboro, Pa.	$68.50	$69.00
Birmingham	62.50	66.50
Boston, deld.	77.79	78.29
Buffalo	66.50	67.00
Chester, Pa.	Nom.	Nom.
Chicago	66.50	66.50
Cleveland	66.50	66.50
Duluth	66.50	66.50
Erie, Pa.	66.50	66.50
Fontana, Calif.	75.50	....
Geneva, Utah	66.50	....
Granite City, Ill.	68.40	68.90
Neville Island (Pittsburgh)	66.50	66.50
Rockwood, Tenn.	62.50	66.50
Swedeland, Pa.	68.50	69.00
Toledo, O.	66.50	66.50
Troy, N. Y.	68.50	69.00
Youngstown, O.	....	66.50

NONFERROUS INGOT

(Cents per pound, carlots)

BRASS AND BRONZE: Red brass, No. 115, 32.00; tin bronze, No. 225, 41.25; No. 245, 35.75; high leaded tin bronze, No. 305, 36.00; No. 1 yellow, No. 405, 27.50; manganese bronze, No. 421, 31.25.

ALUMINUM: Primary alloy No. 13, 25.20; No. 43, 25.30; No. 195, 26.70; No. 214, 28.10; No. 356, 26.00; secondary, No. 12 alloy, 21.25. Deoxidizing grades: No. 1, 22.75; No. 4, 19.50.

MAGNESIUM ALLOY: AZ91A, 40.75; AZ63A, AZ92A, AZ91C, 40.75; f.o.b. Velasco, Tex.

COPPER: Electrolytic 31.00, delivered Connecticut valley.

ZINC: High grade, 12.35, delivered. Diecasting alloy No. 3, 13.75; No. 2, 14.25, delivered.

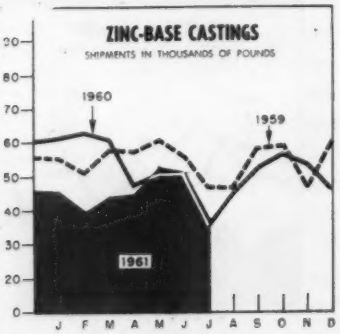
Iron and Steel Scrap

(Consumer prices per gross ton delivered, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Heavy Breakable Cast	Machinery Cast	Structurals, Plates	Malleable	Short Steel Rails
Birmingham	$38.00-39.00	$41.00-42.00	.....	.....	$44.00-45.00	.....	$46.00-47.00
Boston*	**28.50-29.00	**39.00-40.00	.....	**40.00-42.00	.....	.....	.....
Buffalo	31.00-32.00	**38.00-39.00	.....	**45.00-46.00	39.00-40.00	.....	48.00-49.00
Chicago	38.00-39.00	41.00-42.00	.....	46.00-47.00	44.00-47.00	46.00-47.00	49.00-52.00
Cincinnati*	**35.00-36.00	**34.00-35.00	**30.00-31.00	**46.00-47.00	.....	.....	**48.00-49.00
Cleveland	34.00-35.00	37.00-38.00	26.00-27.00	45.00-46.00	39.00-40.00	48.00-49.00	48.00-51.00
Detroit*	32.00-33.00	33.00-34.00	27.00-28.00	.....	.....	.....	.....
Los Angeles	43.00-45.00	46.00-47.00	.....	.....	.....	.....	.....
New York*	30.00-31.00	34.00-35.00	32.00-33.00	.....	34.00-35.00	.....	.....
Philadelphia	40.00	40.00	41.00-42.00	49.00-50.00	44.00-45.00	49.00	52.00-54.00
Pittsburgh	37.00-38.00	**34.00-35.00	.....	**47.00-48.00	40.00-46.00	.....	51.00-53.00
St. Louis*	34.00	35.00	32.00	.....	.....	.....	44.00
San Francisco	40.00	47.00	28.00	45.00-46.00	.....	.....	.....
Seattle***	49.00	41.00	38.00	.....	.....	.....	.....

Brokers' buying prices. **F.o.b. shipping point. ***Prepared, F.o.b. car.

Foundry Statistics



ZINC-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1959	631,210	443,009	.....
1960			
July	35,117	25,186	52,392
7 mo.	389,661	195,908	.....
Aug.	45,101	32,549	57,551
Sept.	52,514	34,451	57,480
Oct.	56,265	36,459	57,028
Nov.	53,574	33,758	55,306
Dec.	46,208	29,341	51,516
Totals	623,203	412,466	.....
1961			
Jan.	46,011	30,311	50,940
Feb.	39,946	26,715	45,453
Mar.	44,130	29,724	43,921
Apr.	44,853	30,225	47,853
May	52,615	34,453	50,054
June	51,240	34,548	45,975
July	37,576	27,023	52,630
7 mo.	318,371	212,999	.....

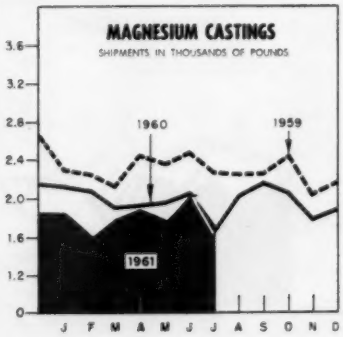
PIG IRON

PRODUCTION*—Net Tons

	Foundry	Malleable & Silvery	Low & Int. Low Phos. & Bessemer
1959	1,889,445	2,810,359	3,471,683
1960			
Aug.	78,950	171,718	211,506
8 mo.	1,013,314	2,125,867	3,040,852
Sept.	93,260	202,895	152,880
Oct.	133,525	183,639	208,758
Nov.	122,550	231,203	206,062
Dec.	130,455	153,009	202,353
Totals	1,454,836	2,902,247	3,732,027
1961			
Jan.	106,054	165,571	170,224
Feb.	98,207	144,476	214,396
Mar.	101,306	159,529	222,688
Apr.	114,050	150,322	189,779
May	118,211	166,365	215,093
June	97,060	186,127	240,287
July	100,404	164,272	289,046
Aug.	106,868	199,270	260,029
8 mo.	843,696	1,335,933	1,801,541

CONSUMPTION*—Gross Tons

	Cupola	Air	Electric
1959	3,989,129	223,868	351,355
1960			
July	241,752	11,892	21,123
7 mo.	2,096,499	120,179	234,469
Aug.	273,722	14,897	27,919
Sept.	284,800	13,548	19,962
Oct.	269,103	13,631	13,947
Nov.	254,799	12,867	17,567
Dec.	233,592	12,722	18,344
Totals	3,412,524	187,644	331,200
1961			
Jan.	232,051	13,293	16,375
Feb.	225,222	12,195	21,705
Mar.	251,524	14,922	18,646
Apr.	242,415	12,208	20,412
May	274,837	13,887	20,262
June	286,761	13,690	19,585
July	211,853	8,715	16,243
7 mo.	1,724,663	87,910	133,228



MAGNESIUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1959	27,253	23,109	.....
1960			
July	1,638	1,234	3,541
7 mo.	13,680	10,627	.....
Aug.	2,025	1,530	3,364
Sept.	2,146	1,653	3,271
Oct.	2,038	1,519	3,274
Nov.	1,776	1,269	3,433
Dec.	1,875	1,345	3,156
Total	23,540	17,943	.....
1961			
Jan.	1,862	1,436	2,847
Feb.	1,610	1,206	2,770
Mar.	1,791	1,360	2,476
Apr.	1,809	1,439	2,888
May	1,764	1,338	2,910
June	2,046	1,460	3,390
July	1,689	1,338	3,235
7 mo.	12,571	9,577	.....

*Source: U. S. Dept. of Interior, Bureau of Mines. **Source: American Iron & Steel Institute. [1]Source: Bureau of the Census. [2]For Sale only. [3]Monthly figures may not add up to totals shown because of unreported monthly revisions.

VOLCLAY BENTONITE

NEWS LETTER No. 76

REPORTING NEWS AND DEVELOPMENTS IN THE FOUNDRY USE OF BENTONITE

SAME SAND-DIFFERENT MOLD HARDNESS

MOLDING SAND MIXTURE	% by Weight
Silica Sand	95.0
Volclay	5.0
Moisture	2.6
Total Mulling Time	8 min.-Slow Muller

Mold Hardness	Green Comp. Strength p.s.i.	Dry Comp. Strength p.s.i.	Permeability No.	Density Grams Per 2" Specimen	Hot Comp. Strength p.s.i. at 1650°F.	Hot Comp. Strength p.s.i. at 1850°F.
30	2.6	18	550	130	...	...
40	3.8	26	417	136	70	100
50	5.4	50	341	140	95	150
60	7.4	54	243	150	130	200
70	9.6	76	212	155	185	230
80	12.5	90	163	160	290	400
85	16.1	105	138	162	380	500
90	16.7	111	112	167	480	580
96	18.4	144	88	172	800	950

Soft ramming is responsible for most mold wall movement. Mold wall movement is measured by mold creep. This develops unsound castings. Shrinkage defects and open porosity are generally created. Cuts, washes, inclusions are possible until the mold hardness is plus 70. **Drops may occur with mold hardness below 70.**

Note the green compression strength was only 2.6 p.s.i. at 30 mold hardness. The same sand at 96 mold hardness was 18.4 p.s.i. This sand reached its leveling period about 85 mold hardness in green compression strength. Molds are difficult to lift when rammed less than 60 with most mixtures. Above 60 mold hardness excellent molding properties are obtained.

Ramming above 85 mold hardness develops possibilities of scabs, buckles or rat-tails. Cellulose additions, such as Cellflo, Five Star wood flour, Carbonized wood flour, and other forms of wood flour may be required.

Mold hardness also changes the hot compression strength rapidly. Note the hot compression strength is approximately 9 times as great at 1850° F. when rammed at 96 mold hardness, compared to the softer 40 mold hardness. This is one fact that is not completely recognized in sand technology. **THE SAME SAND—DIFFERENT PROPERTIES!**

WRITE FOR BULLETIN AF-7 (SANDERS & CLEM)
"How the One-to-Ten Ram Test Measures Sand and Mold Properties"

AMERICAN COLLOID COMPANY

SKOKIE, ILLINOIS • *Producers of Volclay and Panther Creek Bentonite*

For More Information Circle 570, Page 39

WHICH HAS THE ~~KOPE~~-BRAND SEALER?

KOPESEAL

Frederic B. Stevens, Inc.
1800-18th St.
Detroit 16, Mich.
Branches:
597 Northland
Buffalo, N. Y.
440 South Colony St.
Wallingford, Conn.
5345 Lexington Ave.
Indianapolis, Ind.

H. D. Fowler Co., Inc.
9th Ave., South & Lane St.
Seattle 14, Wash.

Ind. Building Materials, Inc. & The Hubbard Co. Div.
2545 So. Yates
Los Angeles 22, Calif.

M. A. Bell Co.
217 Lombard St.
St. Louis, Mo.
Branch: 5802 Colfax St.
Houston, Texas

Railway & Power Engineering Corp. Ltd.
3745 St. James St.
Montreal 3, Quebec, Canada
Branches: 14 in Canada

Jones Foundry Supply
718 E. 60th St.
Los Angeles, Calif.

Barker Foundry Supply Co.
120 South Linden Ave.
So. San Francisco, Calif.

KOPEROPE

Springfield Facing Co.
South Second & Bergen Sts.
Harrison, N. J.

KOPEBEAD

George F. Pettinos, Inc.
1206 Locust St.
Philadelphia, Penna.

KOPETITE

The Hill & Griffith Co.
1262 State Ave.
Cincinnati 4, Ohio

Branches:
4606-10 W. 16th St.
Chicago, Ill.

2929-31 7th Ave., N.
Birmingham, Ala.

1901 Commerce St.
Houston, Texas

No two ways about it! There's nothing "just like" a KOPE-brand sealer, the ready-to-apply cope and drag sealer that has been saving time and money for foundries for years.

Why take a chance when it's so much safer to be sure. KOPE-brands are available as always under their familiar names from outstanding foundry supply houses, strategically located from New Jersey to California, Michigan to Texas.

PRESSTITE Sealing Components

PRESSTITE DIVISION
AMERICAN-MARIETTA COMPANY

3752 CHOUTEAU AVE., ST. LOUIS 10, MO.

61651

NCC Members Will Cosponsor Castings Congress and Show

For the first time, the Castings Congress and Exposition to be held in Detroit's Cobo Hall next May 7-11 will be cosponsored by all members of the National Castings Council. Organizations which are sponsoring the event include the following:

American Foundrymen's Society, Alloy Casting Institute, Foundry Educational Foundation, Foundry Equipment Manufacturers Association, Foundry Facings Manufacturers' Association, Gray Iron Founders' Society, Investment Casting Institute, Malleable Founders Society, National Foundry Association, Non-Ferrous Founders' Society, Steel Founders' Society of America, Training and Research Institute of AFS.

The 1962 Congress and Exposition also will mark the holding of the 29th International Foundry Congress. The latter is sponsored annually by the International Committee of Foundry Technical Associations, which is comprised of foundry technical groups in 22 countries. It was last held in the United States in 1952. As the American member of the International Committee, the American Foundrymen's Society has been authorized to arrange and supervise the 1962 Congress.

Other countries represented on the International Committee include Austria, Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Great Britain, Hungary, India, Israel, Italy, Japan, Netherlands, Norway, Poland, Spain, Sweden, Switzerland, U.S.S.R., and Yugoslavia.

An unusually heavy attendance of foreign foundrymen is expected for the Detroit events, which will have the over-all theme of "Castings Technology for World Progress." Total attendance of 16,000 is looked for. Attractions are expected to include more than 100,000 sq ft of displays of equipment and supplies and about 120 technical papers.

Plastic Patterns Benefit Foundry

● THE ADVANTAGES plastics offer patternmakers have been publicized widely. These include speed of fabrication, elimination of the need for a double-shrink master pattern, and reduced replacement costs. Less publicized, however, are the advantages enjoyed by the foundry using plastic patterns.

In the case of a large slinger pattern for a cast iron polishing wheel, for example, the foundry foreman reported that the biggest advantage was a 75 per cent saving in molding and mold preparation time with a laminated plastic pattern. Sand molding time for the original wood pattern was 16 hours. With the plastic pattern, only 4 hours of molding time was needed. Since the plastic pattern had no wood grain or glue joints, extensive mold finishing was not necessary. In addition to saving time, the pattern permitted a better casting to be made.

Use of the plastic pattern eliminated another problem with the wood pattern. The blades, which were $\frac{3}{4}$ in. thick, $4\frac{1}{2}$ in. high, and 16 ft long, used to warp during use due to absorbed moisture. The plastic pattern, however, absorbed no water and remained dimensionally stable. An additional advantage is the longer life anticipated for the plastic pattern compared with its wood counterpart.

Finally, the hollow, laminated construction of the plastic pattern made it much lighter and easier to handle.

Danko Pattern Co., Baltimore, made this pattern by fabricating two wood master patterns and using them to make two master molds. Altogether, 48 identical blades were required for the pattern, and these were laminated in the two molds. Each blade was located individually on a ramup board and pinned to the center hub and the outside pattern ring.

Material used for the two molds was Epoxical tooling and patternmaking resin, manufactured by U. S. Gypsum Co., Chicago. Epoxical die surface resin was used for the blades to provide good wear characteristics. The actual laminating was done to a $\frac{1}{4}$-in. thickness with tooling cloth 1/16 in. thick.

(*Concluded on Page* 26)

NORTON
ALUNDUM® 3/16 REINFORCED
USE A SAFETY GUARD
A24 RBD
MAX 7100 RPM
MADE IN USA
NORTON
ALUNDUM® 1/4 REINFORCED
USE A SAFETY GUARD
A24 QBUA
MAX 7750 RPM
MADE IN USA

ONLY NORTON BRINGS YOU THESE NEW TIME-SAVERS!

Dis-Card mounts cut BD, BDA wheel changing time from minutes to seconds!

Now you can mount a straight reinforced wheel on a portable grinder without wrestling.

As on the new disc-shaped Cut-N-Saucer wheels, Norton now adds Dis-Card mounts to Types BD and BDA — long the most popular wheels for notching gates and risers, cleaning between the teeth of large gear castings and other everyday foundry jobs.

The new Dis-Card mount is a big improvement over ordinary mounts. It's no separate attachment, but is attached to each wheel — *permanently*. Which means you can change wheels in seconds, completely eliminating "lock washer" action and the struggling that can take up to half an hour. So every BD or BDA wheel you buy is already mounted — and *stays* mounted, until you throw both wheel and mount away.

Yet you pay no more for Norton BD and BDA wheels with Dis-Card mounts than for ordinary wheels.

Final cost is less, in fact, because these straight, rigid wheels are engineered to last longer, cut faster and do more work. In addition to strong reinforcement these wheels have a strong, molded-in safety web. Another unique feature is the layer of cutting grains on the hub side, which speeds cutting action in notching and cutting-off.

For further facts on the new BD and BDA wheels with Dis-Card mounts, see your Norton Distributor, or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

NORTON
ABRASIVES

W-2030

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

(*Concluded from Page 23*)

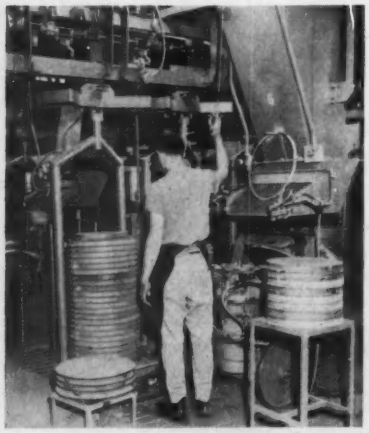
The plastic pattern reportedly cost 10 per cent more than the wood pattern, but the foundry feels that its light weight, dimensional stability, and smooth surfaces make the investment a good one.

New Piston Ring Foundry Is Highly Mechanized

Perfect Circle Corp. has started production at its new $3 million piston ring foundry in Rushville, Ind. It replaces an older plant in Rushville. Perfect Circle also operates a piston ring foundry in New Castle, Ind.

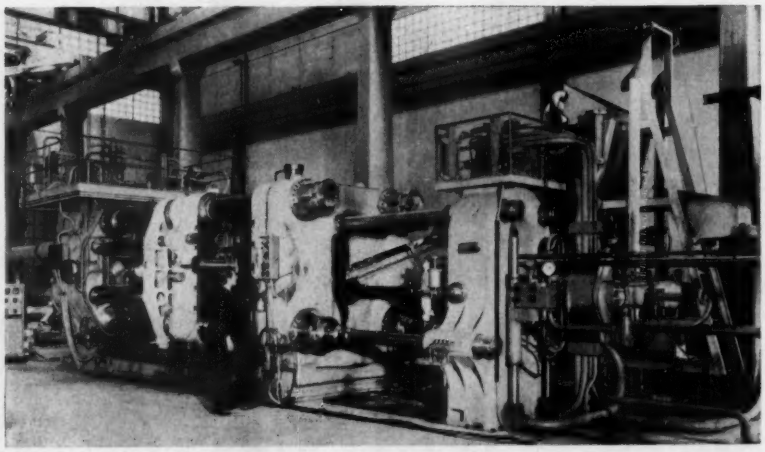
Pushbuttons and pull chains control automatic devices which perform many tasks in the new highly mechanized and ultramodern plant. Heart of the automatic system is an endless conveyor.

In the accompanying illustration



a molder, who has placed a stack of molds on a carrier, pulls a chain to move the filled carrier away and to bring another one in position. At the same time, a second conveyor system automatically delivers sand with the moisture automatically controlled. The filled carrier moves on to predetermined pouring and shakeout stations.

The new foundry has 90,000 sq ft of floor space, 80,000 of it in the manufacturing area.



Diecasts Engine Block in Europe

● A DIECASTING machine with a clamping force of 2425 tons has been designed and built by A. Triulzi S.A.S., Milan, Italy, and is said to be the largest of its type in the world.

The machine is known as the 2200T and has been used successfully to diecast aluminum engine blocks with a net weight of 42 lb and a 55-lb gate. It is designed, however, for the production of an 8-cylinder engine block weighing 99 lb. The first of these units has been bought for that purpose by an automobile manufacturer in the USSR whose purchase includes the furnace and the die as well as the casting machine itself.

Only one worker is required to operate the machine at a rate of 20 pieces an hour. He starts the casting cycle by pushing a button. The machine then automatically clamps the die, measures and injects the molten aluminum, opens the die, and removes the casting.

Maximum injection force is 187.5 tons, and the minimum is 88.2 tons. Platen dimensions measure 79 x 83 in., and dies as large as 79 by 51 11/64 in. can be used. Dies can vary in thickness from 28 3/16 to 47¼ in. Maximum injection capacity is 143.5 lb. The movable platen stroke is 59 1/16 in., and the pump motor is rated at 140 hp. Over-all, the machine is 12 ft 2 in. x 54 ft 2 in. x 17 ft 5 in. Total weight is 253,531 lb.

Ductile Iron Society Plans General Meeting in New York

The Ductile Iron Society will hold a general meeting, in conjunction with the annual meeting of the American Society of Mechanical Engineers, on Nov. 28 at the Governor Clinton Hotel, New York.

From 10. a.m. to 2 p.m., the DIS meeting will feature a roundtable session at which operating problems, new uses for ductile iron, and society activities will be discussed. After luncheon, the meeting will adjourn so that members may participate in the ductile iron session at the ASME meeting during the afternoon.

At the ASME session, four papers will be presented. A method of producing ductile iron by the addition of yttrium will be described in "Yttrium Nodular Iron," by J. J. Kanter, J. P. Magos, and W. L. Meinhart, Crane Industrial Products Group, Crane Co.

Other papers will deal with ductile iron applications. They include "Some Engineering Applications of Ductile Iron Castings," by Sam Carter and J. J. Dow, American

(*Concluded on Page 30*)

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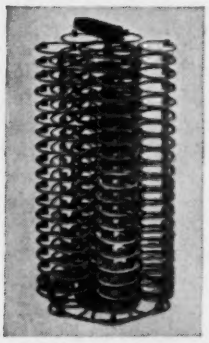
Cast iron parts, produced by Perfect Circle's unique casting techniques, are used in critical wear points in both cast iron and non-ferrous engines. Cylinder liners are centrifugally cast, piston inserts and rings are produced by the stacked mold process. Gray iron valve guides are virtually a must for engines with non-ferrous cylinder heads. In each case, Republic Pig Iron is the base metal. Simple economics dictate the use of cast iron parts to resist wear at critical points.

REPUBLIC PIG IRON SPECIFIED FOR STACKED MOLD, CENTRIFUGAL CASTING

Uniform Chemistry, High Quality are Ideal for Unique Processes

In these two casting processes—stacked mold and centrifugal—Perfect Circle Corporation maintains stringent quality control programs. Control begins with the selection of pig iron. To suit Perfect Circle's metallurgists, the iron must have a perfectly uniform chemical composition with exact graphite distribution, and be of consistent high quality. To produce the gray iron parts on the opposite page, by the casting methods described below, Perfect Circle selected Republic Pig Iron as the base metal.

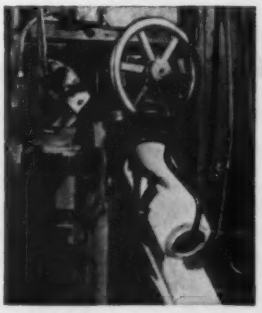


STACKED MOLD

In this process, stacks of green sand molds move along conveyors to the pouring station. Metal may come direct from a cupola or from an electric furnace. As the stacks cool they move to the shake-out station, where the cast "Christmas trees" are lifted and shaken free of the copes and sand.

By this process, Perfect Circle is able to produce several hundred castings at one pour. Dimensions are limited only by the depth and diameter of the cope.

CENTRIFUGAL



This process begins with installation of a permanent mold into a spinner where it is heated, spun to an interior force of 120 gravities, and coated. A measured weight of metal is poured into the mold. Through precise control of the mold temperature and the coating, the cooling rate is regulated to produce the desired microstructure. The spinning process squeezes gases and nonmetallic impurities out of the metal, and continues until the casting temperature drops to 1500°–1700°. The finished casting is then removed.

The castings are end-cropped to length and machined. The process allows a significant reduction in scrap loss, stock removal allowances, machining time, and costs.

REPUBLIC'S COMPLETE FOUNDRY ENGINEERING SERVICE is available to all foundries without obligation. Republic Foundry Service Engineers can supply ideas, suggestions, and information to benefit every department of your foundry operation. They can recommend, from industry's most complete line of merchant pig iron, the grade best suited to your requirements: Chateaugay; Northern Foundry, Malleable, Bessemer and Basic; Southern Malleable, Foundry and Basic.

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For More Information Circle 574, Page 39

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(*Concluded from Page 26*)
Cast Iron Pipe Co.; "Uses of Ductile Iron in Paper Mill Machinery," by F. C. Hardick, Sandy Hill Iron & Brass Works, and "Applications of Ductile Iron in Special Machinery and Electrical Power Fields," by R. J. McGiveny, Crompton & Knowles Corp.

James H. Lansing, executive secretary, DIS, will be chairman of the ASME session, and Robert B. Larson, manager of product engineering, Warner & Swasey Co., will be vice chairman.

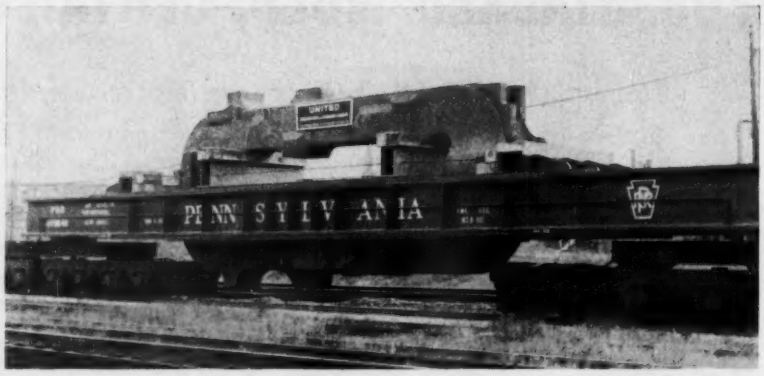
Visitors from Abroad Study Shaw Process Developments

Foundry specialists from England and India are shown here as they watch a demonstration of a new development in the Shaw process ceramic mold casting method. The

visitors are studying new designs for automated equipment at the Port Washington, N. Y., foundry and metallurgical laboratory of Shaw Process Development Corp., a division of Avnet Electronics Corp.

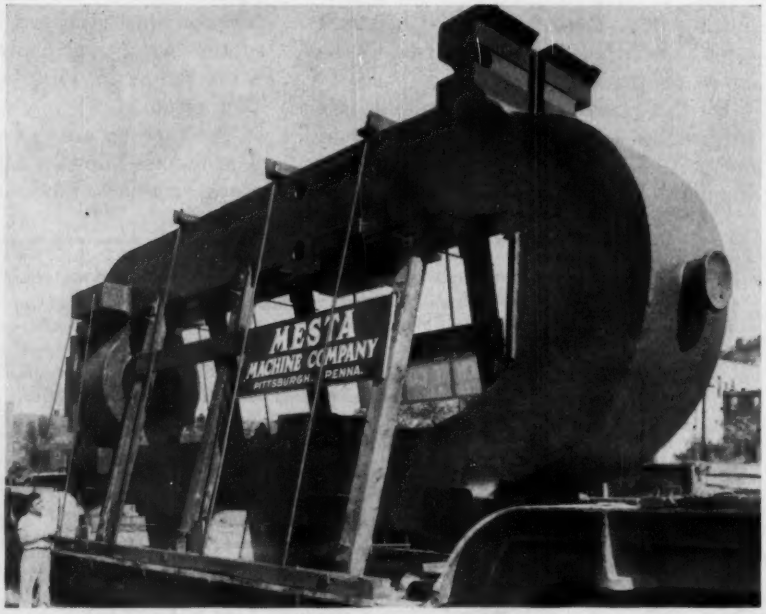
Shown here, left to right, are Norman A. Shaw, director, Clino Factory Supplies, England; Geoffrey W. Paget, chief metallurgist, Shaw Process Development Corp.; Gerry Brown, technician, Foundry Equipment Ltd., England; David L. Collett, development engineer, Foundry Equipment Ltd.; Ralph Brian Shaw, technical director, Shaw Process India, India; Mitchell Pollack, foundry technician, Shaw Process Development Corp. Both Shaws are nephews of the discoverers of the process.

Mill Castings on the Move



● TOP, a specially designed, 120-ft. railroad car carried the first of a pair of 214-ton cast steel plate mill housings from the Youngstown, Ohio, plant of United Engineering & Foundry Co. to New York city for shipment to Dunkirk, France.

At the bottom, what the producer claims is one of the two largest mill housings ever made is shown ready for shipment by Mesta Machine Co., Pittsburgh, to U. S. Steel Corp., Gary, Ind. Over 500 tons of open-hearth steel was poured for the two housings, each of which measures 35 ft 4 in. high, 15 ft 6 in. wide, and 5 ft 8 in. thick. They are for the world's largest plate mill, the first designed to operate as either a 210 or 160-in. wide mill.



Gray Iron Design Contest Winners Are Announced

R. M. Gold, Dayton Rogers Co., Minneapolis, won first prize ($500) in the 1961 design contest sponsored by the Gray Iron Founders' Society, Cleveland.

Mr. Gold placed first for his ingenious substitution of gray iron for a fabricated steel knife slide on a shell trimmer at a substantial sav-

(*Concluded on Page 32*)

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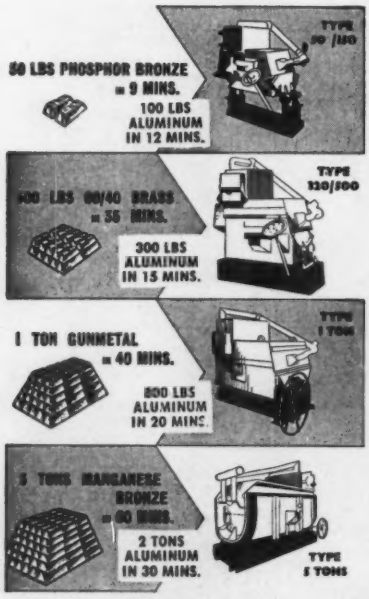

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For More Information Circle 576, Page 39

(Concluded from Page 30)

ing in manufacturing costs. Other advantages in the change were weight reduction and improved appearance.

Second prize ($100) was shared by L. F. Fougere and W. B. Moyer, General Electric Co., Schenectady, N. Y., for improvements in the design of a bearing and inlet casing for a gas turbine compressor.

Six third-prize ($50) winners were P. J. Binker and C. W. Mathues, National Airoil Burner Co., Philadelphia; A. S. Melilli, General Electric Co., Everett, Mass.; E. B. Melton, Dominion Engineering Co. Ltd., Montreal, Canada; C. L. Peterson, Uarco Inc., Chicago; and L. C. Noriega, General Telephone & Electronics Corp., Salem, Mass.

The prizes will be presented at the GIFS annual meeting at the Royal York Hotel, Toronto, on Oct. 20.

Superior Foundry Inc. Closes

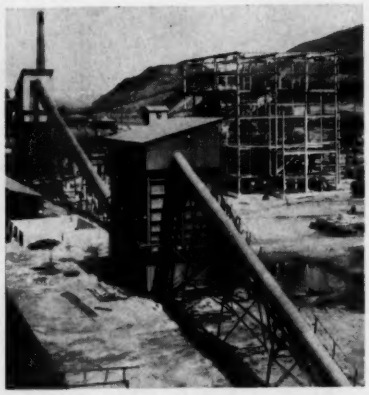
Superior Foundry Inc., Cleveland, will discontinue business on Nov. 10 after 71 years of operation. According to Walter L. Seelbach, president, the main factor affecting the decision to close the foundry was the current profit squeeze situation. The foundry is for sale.

Mr. Seelbach stated, "The foundry is not in financial difficulty." It employed some 350 workers and produced castings for truck, electrical, and farm equipment industries in northeastern United States.

AFS Student Chapter Chartered At General Motors Institute

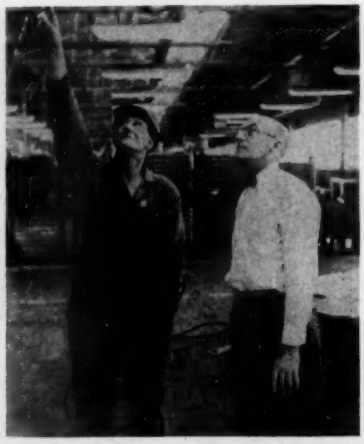
The American Foundrymen's Society's 15th student chapter was organized and chartered recently at General Motors Institute, Flint, Mich. There are approximately 60 charter members in the chapter.

Since GMI operates on a co-operative basis, with students alternately attending classes and working in GM divisions, a double set of officers was elected by the chapter. Alternating as president for 1961-62 are Marvin Gabalski, Detroit, and Raymond Landskroner, Frankenmuth, Mich. Vice presidents are Thomas Weigandt, Defiance, Ohio, and Robert Roach, Bedford, Ind.



BUILDS SMELTER: Spiegeleisen, the iron-manganese alloy used by iron and steel foundries, will be produced by New Jersey Zinc Co. at Palmerton, Pa., when the company's new smelting plant is completed in 1962. Shown in this view are the ore storage bin and conveyor, center, and framework for an electric furnace, upper right

Secretary-treasurer for the year is Mike Pike, Mecosta, Mich. Faculty advisors are Donald A. Bergh, Harold O. Haskitt Jr., John L. Lowe, and Edward J. Preville. Chairman of the industrial advisory committee is John R. Ikner, plant manager, Chevrolet-Saginaw Gray Iron Foundry.



HEAD PROTECTION WORKS: Head injuries to Edward L. Wilson, millwright, (left) were prevented by his safety helmet when the steel sling he is holding struck him after falling 35 ft. He is explaining the incident to Gene Curry, who is safety supervisor at the International Harvester Co. plant in Memphis, Tenn., where they work. The helmet is laminated plastic and was made by Mine Safety Appliances Co., Pittsburgh

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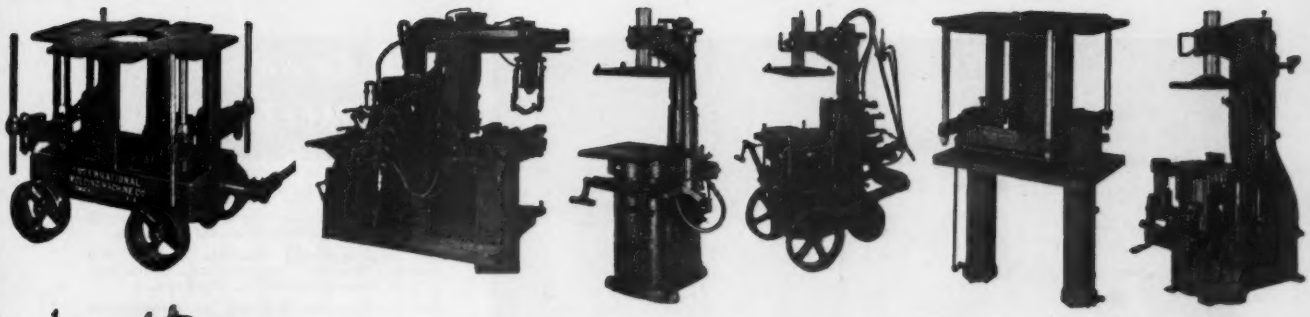

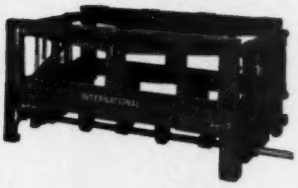

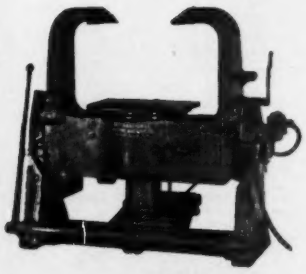

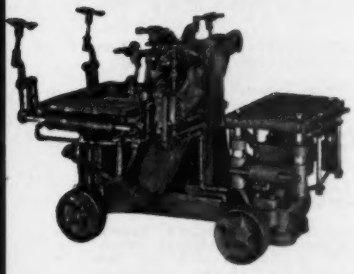

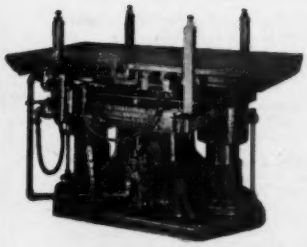

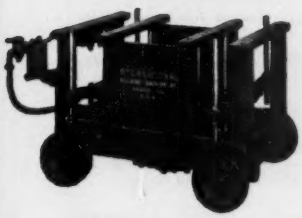

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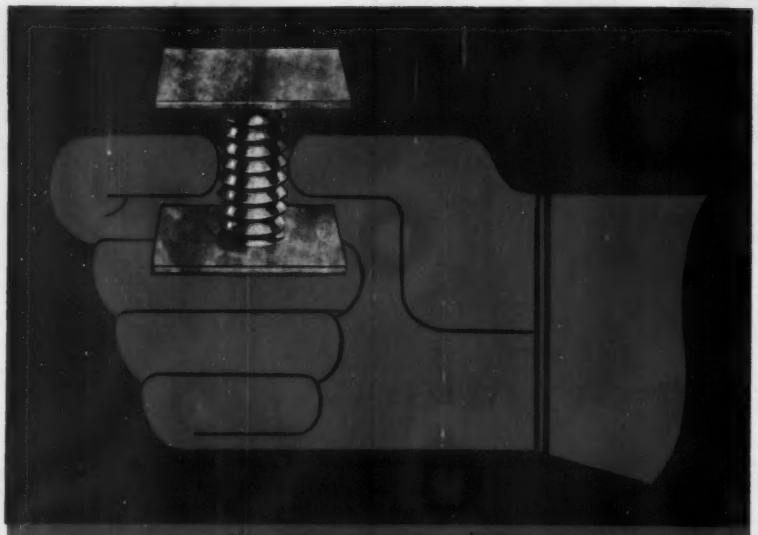

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Calendar of MEETINGS

Nov. 1-2—Investment Casting Institute, annual meeting, Park-Sheraton Hotel, New York.

Nov. 1-3—Malleable Founders Society, 12th annual Market Development Conference, Hotel Sheraton-Cleveland, Cleveland.

Nov. 3—American Institute of Metallurgical Engineers, Pittsburgh Section, radioisotope meeting, Pittsburgh, Pa.

Nov. 13-15—Steel Founders' Society of America, Technical & Operating Conference, Hotel Pick-Carter, Cleveland.

Nov. 15-17—National Foundry Association, annual meeting, Savoy-Hilton Hotel, New York.

Nov. 26-Dec. 1—American Society of Mechanical Engineers, winter annual meeting, Statler-Hilton Hotel, New York.

Nov. 27-29—Plumbing Brass Institute, annual meeting, Savoy-Hilton Hotel, New York.

Nov. 27-Dec. 1—28th Exposition of Chemical Industries, New York Coliseum, New York.

Nov. 28—Ductile Iron Society, general meeting, in conjunction with the annual meeting, American Society of Mechanical Engineers, Governor Clinton Hotel, New York.

Dec. 1—Malleable Founders Society, semiannual meeting, Hotel Sheraton-Cleveland, Cleveland.

Dec. 6-8—American Institute of Mining, Metallurgical, & Petroleum Engineers, Electric Furnace Conference, Penn-Sheraton Hotel, Pittsburgh.

1962

Jan. 8-12—Society of Automotive Engineers, annual meeting & Engineering Show, Cobo Hall, Detroit.

Jan. 22-23—Industrial Heating Equipment Association, annual winter meeting, Drake Hotel, Chicago.

Feb. 6-8—Material Handling Institute Inc., spring meeting, Hilton Inn, Atlanta.

Feb. 8-9—Wisconsin Regional Foundry Conference, Schroeder Hotel, Milwaukee.

Feb. 15-16—Southeastern Regional Conference, Hotel Tutwiler, Birmingham.

Feb. 28-Mar. 1—Malleable Founders Society, Annual Technical & Operating Conference, Hotel Pick-Carter, Cleveland.

March 12-13—Steel Founders' Society of America, annual meeting, Drake Hotel, Chicago.

March 15-16—Texas Regional Conference, Hotel Menger, San Antonio, Tex.

Apr. 11-12—Foundry Educational Foundation, annual college-industry conference, Statler-Hilton Hotel, Cleveland.

Apr. 30-May 1—Magnesium Association, annual meeting, Jack Tar Motel, Galveston, Tex.

May 7-11—American Foundrymen's Society, 66th Annual Castings Congress & Exposition (held in conjunction with the 29th International Foundry Congress), Cobo Hall, Detroit.

May 28-29—Malleable Founders Society, annual meeting, Homestead, Hot Springs, Va.

June 19-21—Material Handling Institute, Great Lakes Show, Cobo Hall, Detroit.

June 24-29—American Society for Testing Materials, annual meeting & Apparatus Exhibit, Statler-Hilton Hotel, New York.

Sept. 1-9—German Foundry Trade Fair and annual meeting, German Foundrymen's Technical Association, Dusseldorf, Germany.

Sept. 25-28—Society of Diecasting Engineers, 2nd National Diecasting Exposition & Congress, Cobo Hall, Detroit.

Oct. 3—Cast Bronze Bearing Institute, Broadmoor, Colorado Springs, Colo.

Oct. 4-6—Non-Ferrous Founders' Society, Broadmoor, Colorado Springs, Colo.

Oct. 10-12—Gray Iron Founders' Society, annual meeting, Drake Hotel, Chicago.

Oct. 18-20—Foundry Equipment Manufacturers' Association, annual meeting, Greenbriar, White Sulphur Springs, W. Va.

For More Information Circle 578, Page 39

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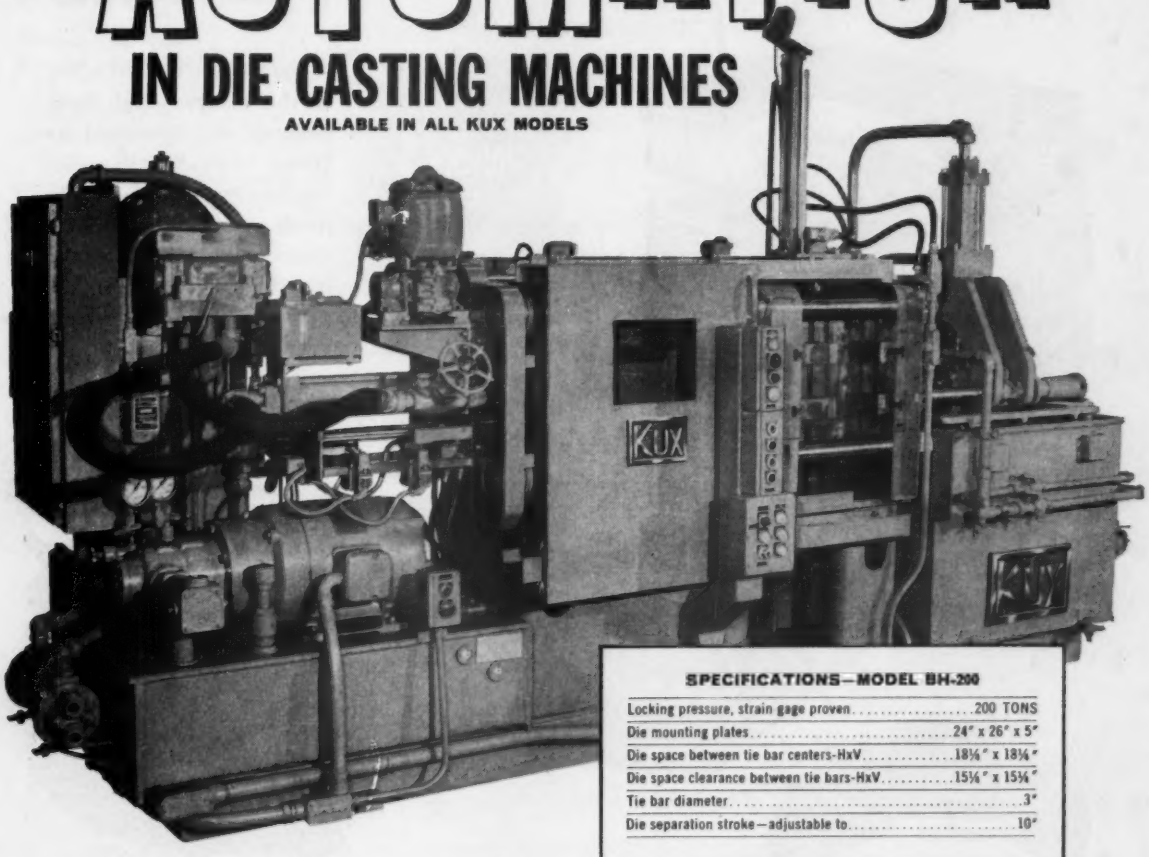

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Locking pressure, strain gage proven	200 TONS
Die mounting plates	24" x 26" x 5"
Die space between tie bar centers-HxV	18¼" x 18¼"
Die space clearance between tie bars-HxV	15¼" x 15¼"
Tie bar diameter	3"
Die separation stroke—adjustable to	10"

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Incorporated into this machine cycling mechanism is a low pressure approach of the moveable die plate, flash sensing switches, air jets for cleaning die faces, casting sweep arm, and die lubricating unit with adjustable interval timing. Also available in cold chamber models for casting aluminum with KUX "AUTO-FEED" system of vacuum die casting.

ADDITIONAL FEATURES in the 28 all-new strain gage proven KUX models are the revolutionary "VAC-U-DIE" and "AUTO-FEED" systems of vacuum die casting—motorized die height adjustment mechanism—and the patented KUX injection pressure multiplier for cold chamber models with injection pressures up to 36,000 PSI and plunger speeds up to 12,000 inches per minute.

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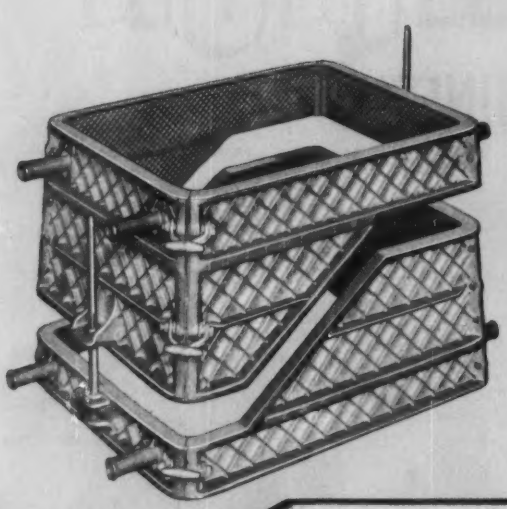
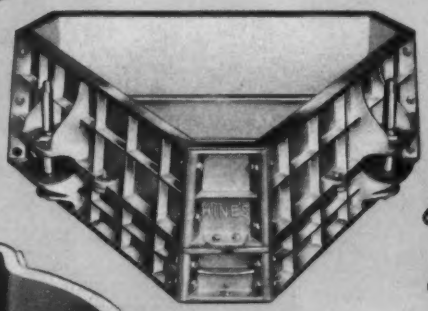
Write for full details of the 28 all-new KUX models illustrated in the latest KUX Die Casting Machine Catalog.

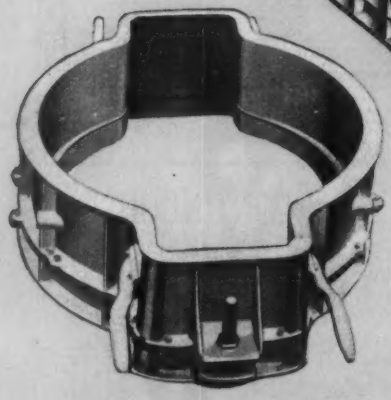
HINES SPECIAL FLASKS

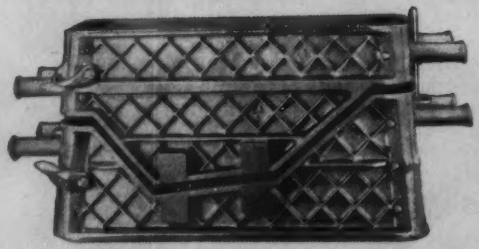


HINES POP-OFF FLASK MEMBER FEMA

• Shown here are but a few of the many special flasks designed and fabricated by HINES to do difficult molding jobs more efficiently. In many cases, HINES has been able to design flasks for making castings previously considered impractical, if not impossible to produce. Many of these special flasks incorporate the familiar HINES "POP-OFF" corner release mechanism, to further speed up production, increase accuracy of the mold and prolong flask life.







It's entirely possible that a HINES "special" may be the answer to that difficult molding problem now confronting you. Our engineering department will gladly submit recommendations. A phone call, wire or letter will put them on the job at once.

THE HINES FLASK CO.

3431 WEST 140th STREET • CLEVELAND 11, OHIO

ORchard 1-2806

HINES FLASKS

Reader Information Service

Advertising content in FOUNDRY is classified by subject and listed by page number for your convenience when studying specific foundry applications. For further information on subjects advertised, refer to advertisement on the page indicated and circle Item Number on Reader Service Card—Page 39

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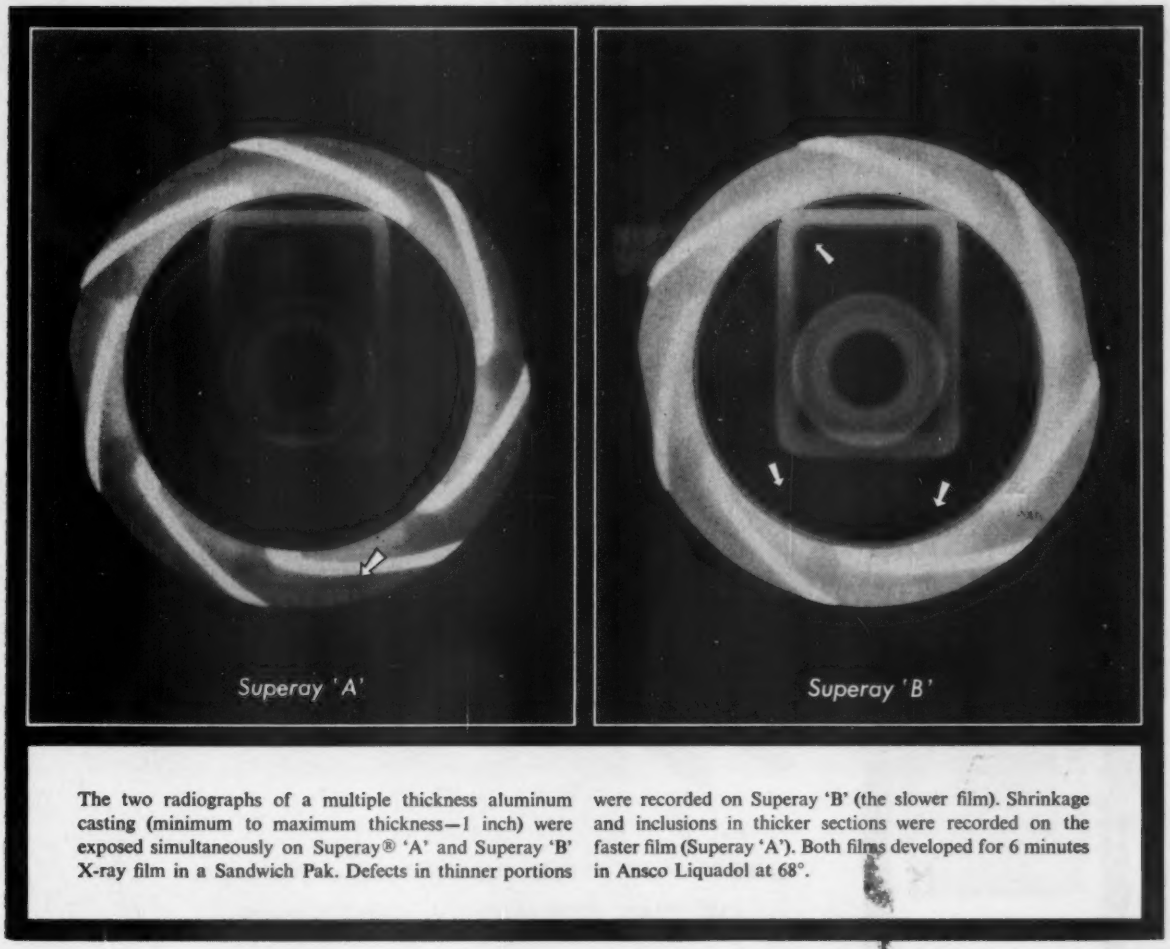


The two radiographs of a multiple thickness aluminum casting (minimum to maximum thickness—1 inch) were exposed simultaneously on Superay® 'A' and Superay 'B' X-ray film in a Sandwich Pak. Defects in thinner portions were recorded on Superay 'B' (the slower film). Shrinkage and inclusions in thicker sections were recorded on the faster film (Superay 'A'). Both films developed for 6 minutes in Ansco Liquadol at 68°.

Ansco Sandwich Pak cuts X-ray time in half!

MULTIPLE THICKNESS CASTINGS X-RAYED WITH ONE EXPOSURE! ELIMINATES DARKROOM LOADING!

Ansco Sandwich Pak is a single unit package for daylight handling... made up of one sheet of Superay 'A' Film sandwiched with one sheet of Ansco Superay 'B' Film. Ideal for obtaining maximum readability in radiographs of multiple thickness parts with a single exposure. Especially useful for low energy work where parts must be radiographed in quantity.

- **Cuts set-up time in half.**
- **Eliminates darkroom loading and film holders.**
- **Increases latitude of any given exposure.**
- **Lightweight, flexible (can be taped to part).**
- **Factory sealed against dust, dirt.**

Ansco, Binghamton, N.Y.
A Division of General Aniline and Film Corporation

Ansco
X-ray

For More Information Circle 581, Page 39

CAST FOR THE RESEARCH NEEDS OF THE FOUNDRY INDUSTRY

The Magcobar Research and Development Center at Arlington Heights, Illinois, helps the Foundry Industry produce better castings at lower costs through research.

With the Center's pilot foundry, Magcobar sand engineers are able to duplicate the entire castings operation and study sand properties, bonding materials, and mixing techniques. From such research comes valuable information to help foundries improve castings.

Research findings are used by Magcobar to develop new foundry products and to perfect the utilization of its foundry bentonites, Yellowstone®, Auto-Bond®, and Southern Star®.

The Research and Development Center is the first such facility to be owned and operated by a foundry supplier. If your concern is better castings, it will pay you to investigate Magcobar service. Write for free booklet, "Progress is the Fruit of Research."

For information about Yellowstone, Auto-Bond, and Southern Star, see your local Magcobar dealer.

MAGNET COVE BARIUM CORPORATION
P. O. Box 355
Arlington Heights, Illinois

Magcobar® FOUNDRY PRODUCTS

the really tough jobs are blown on FLEXIBLO®

Blown Harder, Faster and at Lower Cost

From B & P RESEARCH

The most intricate cores, previously made only by the most skilled bench core makers, are now made push-button fast on Beardsley & Piper's Flexiblo. Costly, time consuming bench coremaking has been eliminated in many foundries by Flexiblo's outstanding productive capacity and flexibility.

The Flexiblo is so flexible that core box changes are made in seconds. So versatile that even unvented, wooden core boxes are routinely handled, yet cores are blown harder, faster and with less core box wear than on any other blower. Piping or channeling of sand in magazines is eliminated as a result of the B&P specially engineered blow valve . . . and Flexiblos start producing the minute they arrive at your foundry. Core box modifications are rarely required—and skilled core makers are *never* required.

Flexiblos are available for cores ranging in size from the smallest to 500 lbs. and are the result of intensive research, development and proving by B&P engineers. The balanced, versatile design is ideal for either jobbing or production work, and offers every feature of proven value in the foundry field . . . greatest productive capacity . . . semi-automatic or fully-automatic control . . . proven safest operation . . . minimum maintenance . . . and the Flexiblo blows all types of sands. Foundrymen report that Flexiblos, because of savings realized through these features, pay for themselves in a matter of months.

Your Beardsley & Piper representative will be happy to survey your core room needs and make his recommendations. He is well equipped through training and experience to aid in your selection. His recommendation, backed by B&P research and engineering, is your assurance of lasting satisfaction.

BEARDSLEY & PIPER
Div. of Pettibone Mulliken Corp.
2424 N. Cicero Ave., Chicago 39, Ill.

For More Information Circle 583, Page 39

CORE MAKING METHOD									
BINDER	CHEM-REZ "100"	CHEM-REZ "100" with LINOIL	CHEM-REZ A-200	LIN-O-SET	LINOIL	ADCOSIL	ADMIREZ PHENOLIC	ADMIREZ PHENOLIC	ADMIREZ UREA
PROCESS	HOT BOX	OVEN BAKE	NO-BAKE	AIR SET	OVEN BAKE	CO_2	SHELL	OVEN BAKE	OVEN BAKE
CURING PRINCIPLE	Chemical & Heat	Chemical & Heat	Chemical	Catalytic, Oxidation & Heat	Heat	Chemical	Heat	Heat	Heat
RANK in relation to:									
ACCURACY (core dimensions)	1	2	1	1	2	1	1	2	2
SPEED OF PRODUCTION (output per worker)	1	3	5	6	4	2	2	4	3
ECONOMY (Sand Mixture)	3	2	7	6	1	4	7	5	2
CONVENIENCE (Handling, Tooling or Precautions)	1	5	3	4	5	2	2	5	5
SIMPLICITY (Core quality Control)	2	1	5	6	1	4	3	1	1
VERSATILITY (Range of metals & core type)	2	2	4	4	1	5	3	3	4

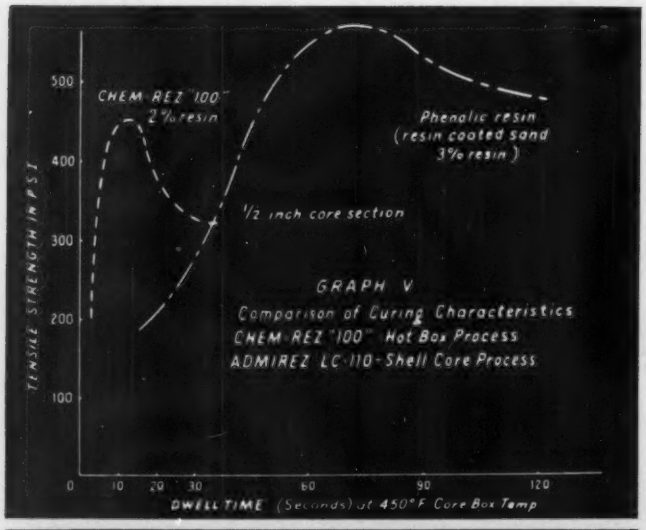
NOTE: Rankings given are in terms of "order of preference." No attempt is made in this comparison table to rate the various processes in terms of their relative value in each functional category.

CHEM-REZ "100" RANKS FIRST in VALUE ANALYSIS of nine different types of ADM core binders!

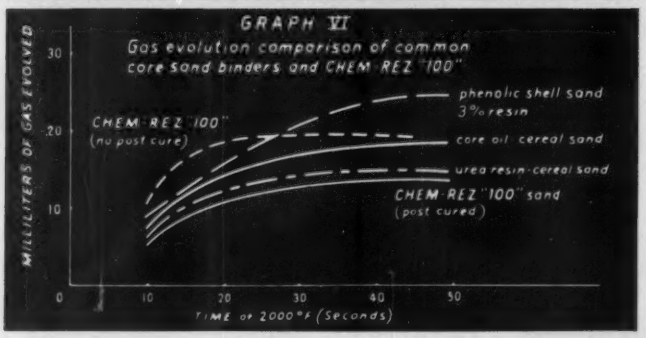
A comprehensive technical bulletin on CHEM-REZ "100" has been published by ADM to keep foundrymen up to date on the latest performance and application data. A copy is yours for the asking.

Graphs V and VI (below), taken from this 16-page bulletin, are typical of its contents. Other charts and tables cover: sand mixtures and cycles; core box temperatures; effect of resin and catalyst content; comparison of various types of catalysts; effect of core section thickness on tensile strength build-up; and comparative high temperature properties of CHEM-REZ and oil and cereal cores.

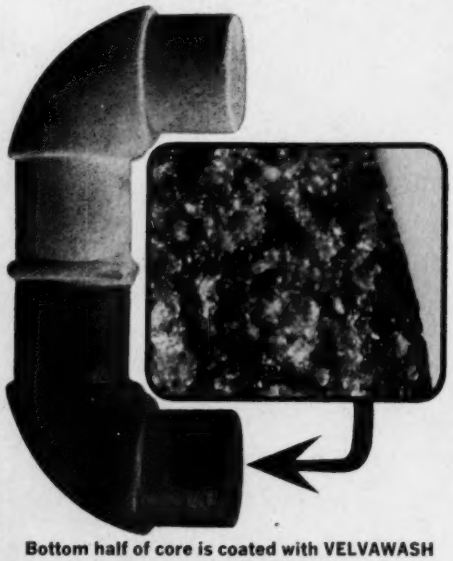
Also discussed is the application of CHEM-REZ "100" to various curing techniques such as: hot box; combined core oil and resin; oven baking — conventional, dielectric, infra-red, or re-dry. Write to ADM for your copy.



GRAPH V
Comparison of Curing Characteristics
CHEM-REZ "100" Hot Box Process
ADMIREZ LC-110-Shell Core Process



GRAPH VI
Gas evolution comparison of common core sand binders and CHEM-REZ "100"



Bottom half of core is coated with VELVAWASH CR-100 . . . the wash that's MATCHED to CHEM-REZ "100" cores.

Twenty-power magnification above shows CHEM-REZ "100" hot box core coated with VELVAWASH CR-100. This wash clings tightly without penetrating so deeply that strength of the surface is deteriorated. Write for information.

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Newaygo Offers Foundrymen TWO EASY WAYS for securing NEEDED EQUIPMENT *NOW!*

"Newaymation" Units or Systems can help YOU increase production, quality and PROFITS by either a

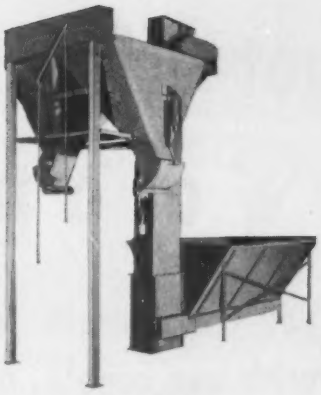
LEASING Arrangement

or a

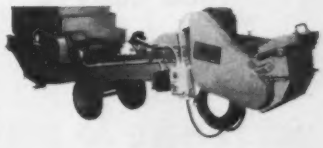
FINANCING Plan!

LEASING Arrangement: Down payment of one month's payment for each year of contract. Arranged for up to 5 years' duration. Then you have two options — *1* Continue lease with one annual rental payment per year, equal to only 2% of original purchase price of equipment, which is less than monthly payments under original lease. 2. Purchase equipment for an amount equal to only 6% of the original purchase price.

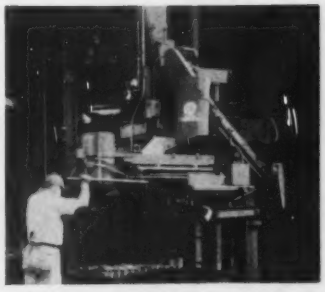
FINANCING Plan: On equipment purchases totaling $3,000 to $10,000, a down payment of only 20%, financing balance for from 12 to 36 months. On purchases totaling $10,000 to $20,000, down payment of only 15% to 20%, balance financed for from 12 to 48 months. On purchases totaling $20,000 or more, initial payment of only 10% to 20%, financing balance for from 12 to 60 months.



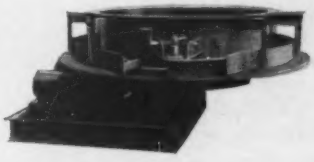
Handy Sandy



Reddy Sandy



Single & Double Arm Pivoting Flask Fillers



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Read how this Eastern foundry got efficient cupola dust control at a tremendous saving

IF you can operate your foundry with one cupola, and...

IF you need cupola dust control...

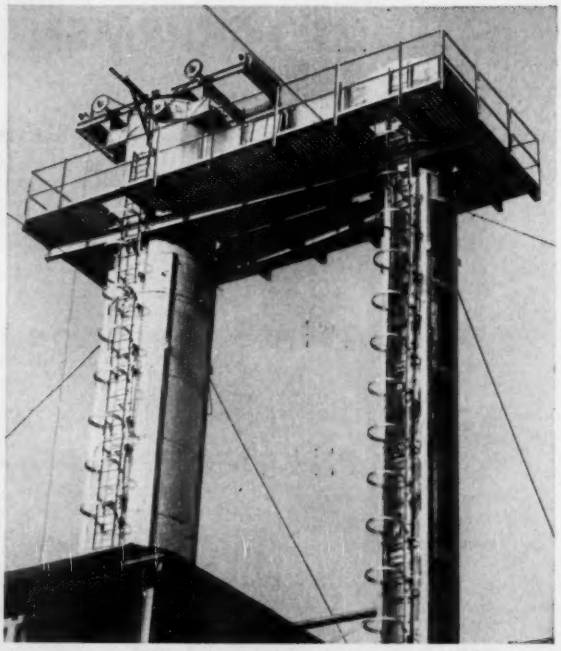
you're sure to profit from Brown & Sharpe's experience

Ingenious engineering — including an AAF AMERclone dust collector—has transformed an obsolete cupola into a modern one at Brown & Sharpe foundry . . . at a total cost far less than anyone thought possible. Here's how it came about:

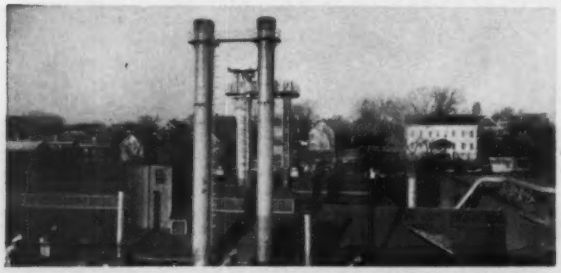
Brown & Sharpe needed effective dust control on one of their twin-cupola installations. But due to changes in the nature of castings produced, they no longer needed the *capacity* provided by both cupolas.

Selection of the dust collector was no problem. The AAF AMERclone is the proved collector for complete cupola dust control. Creative engineering took over from there. Instead of *building* a cooling tower for the dust collection system, one of the cupola stacks was converted into a cooling tower and became an integral part of a modern, single-cupola installation.

Thus, Brown & Sharpe transformed an over-capacity twin cupola that was creating a dust problem into a dust-free single cupola of realistic capacity — with an absolute minimum of new construction.



Closeup view of old double cupola after conversion to single cupola with AAF dust control. Old cupola at right now serves as a cooling tower for system.



A view of Brown & Sharpe foundry, Providence, Rhode Island. In background is single cupola equipped with AAF dust control. Before conversion, it was similar to double-cupola installation in foreground.

The AAF AMERclone *gets* the particles that cinder catchers miss — the little particles that create the big problems. Dust is collected dry, simplifying disposal and eliminating possibility of corrosion of the collecting system. In many installations, one AMERclone handles two cupolas alternately, permitting full-time use of equipment.

AAF's complete line of dust control equipment was application-developed, now challenges *any* foundry dust problem.

If your problem is cupola dust, contact your local AAF representative, or write direct for Dust Control Bulletin 291. Address: Mr. Robert Moore, American Air Filter Company, Inc., 266 Central Avenue, Louisville, Kentucky.

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HIGHEST QUALITY CHAPLETS and CHILLS at LOWEST COSTS

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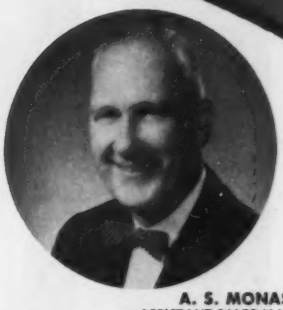

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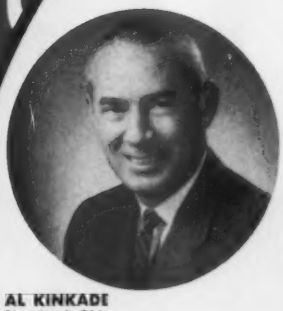

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MAN-HOURS SAVED TODAY WITH ARCAIR

Because it is such a dramatic time and money saver, foundries are one of the biggest users of the Arcair metal removal process. Look at these foundry testimonials:

"Arcair saved us $135,000 in a single year . . ."

"We've built an addition to our plant, around the Arcair process, replacing our swing-grinders."

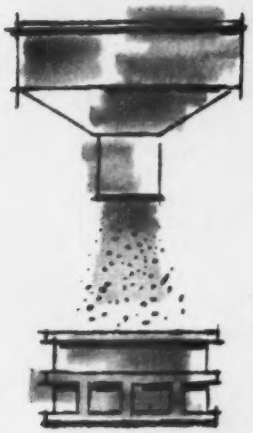
"Removing risers and riser pads and defect removal with Arcair has slashed our cleaning room costs by 78%."

"Arcair removes metal 4 to 5 times faster than our previous method . . ."

Arcair cuts, gauges, flushes any metal. For best results and greater savings be sure your electrode bears the Arcair trademark. A fifteen-minute demonstration will prove it. Call your welding supply distributor or write to The Arcair Company, 465 S. Mt. Pleasant St., Lancaster, Ohio.

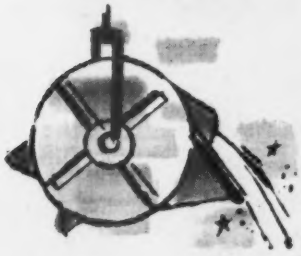
SAND-MEX®

IMPROVES FLOWABILITY FOR BETTER CASTING RESULTS

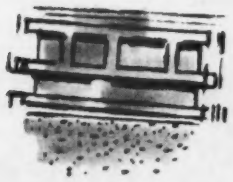


IN MULLING
SAND-MEX reduces friction between sand grains, resulting in greater flowability. All the sand in the system can be used. SAND-MEX also reduces wear and abrasion on sand handling equipment.

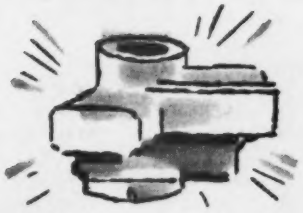
IN MOLDING
SAND-MEX increases stability of foundry sand; makes possible sharper pattern impressions.



IN POURING
SAND-MEX puts a graphitic film on sand which inhibits chemical and physical reaction, helps eliminate rat-tails, scabs, etc. Expansion and contraction of sand is reduced when metal is poured into the mold.



IN SHAKEOUT
SAND-MEX prevents sand from becoming strongly fused after pouring; it's easily broken down. Shakeout time is thus reduced and casting damage minimized.



BETTER CASTING RESULTS
SAND-MEX makes possible cleaner castings with better color and finish that are truer to pattern. Machining and labor costs are reduced.

For better casting results, use SAND-MEX, available in 50 lb. bags.

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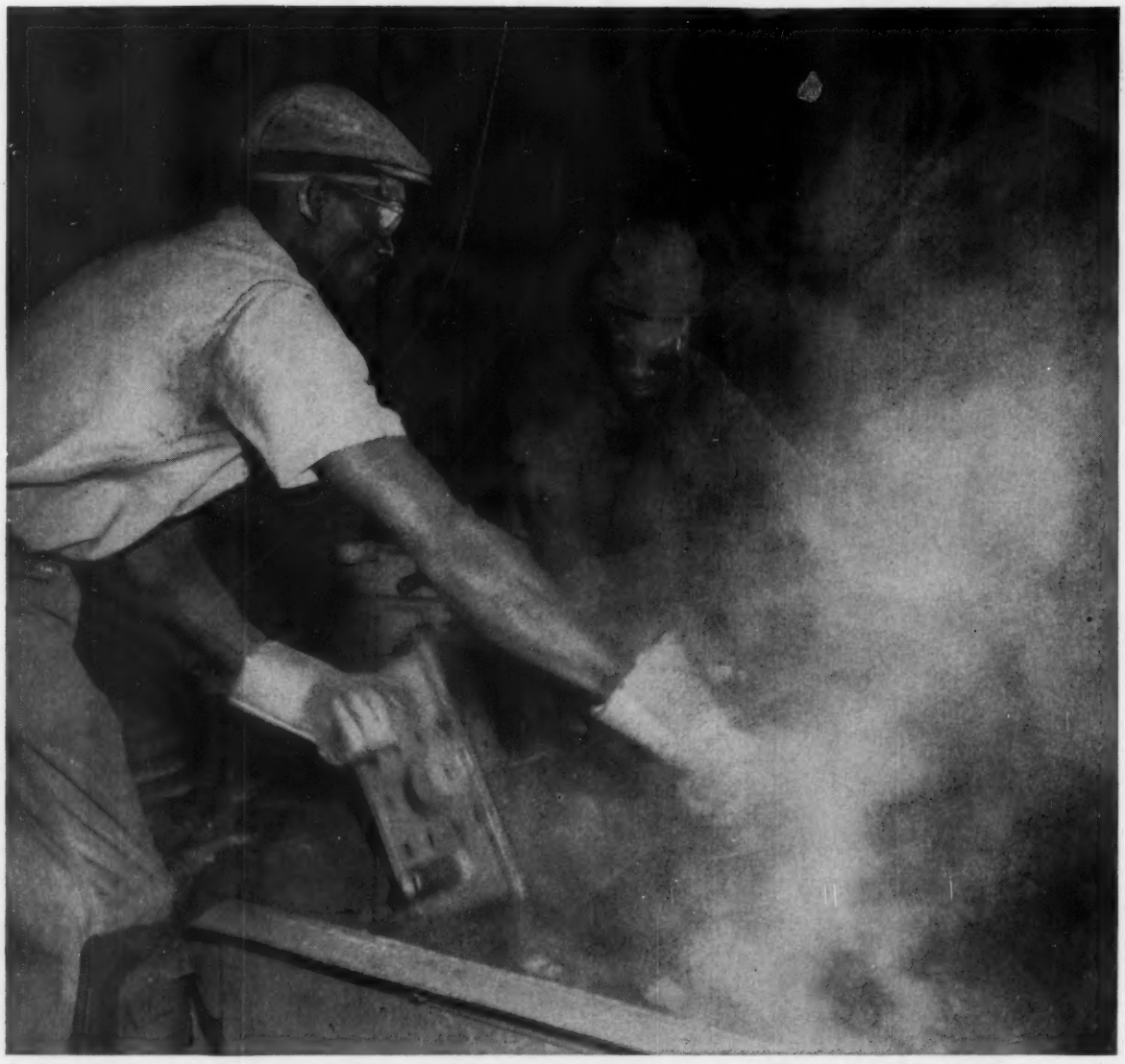


Where belts carrying hot sand now last 50% longer

THOSE men are dumping hot sand from molds into a shake-out grid. The 250-degree sand falls through the grid and down on a conveyor belt nine feet below. But the heat is so intense it even blistered and scorched rubber belts that were supposed to have been specially designed for hot-material service. Belts were only lasting 3 or 4 months.

When a B.F.Goodrich man heard of the problem, he recommended a new conveyor belt called Solarflex. This B.F.Goodrich belt is made of a special rubber that stays soft and pliable at temperatures that cause other belts to harden, crack and finally break down.

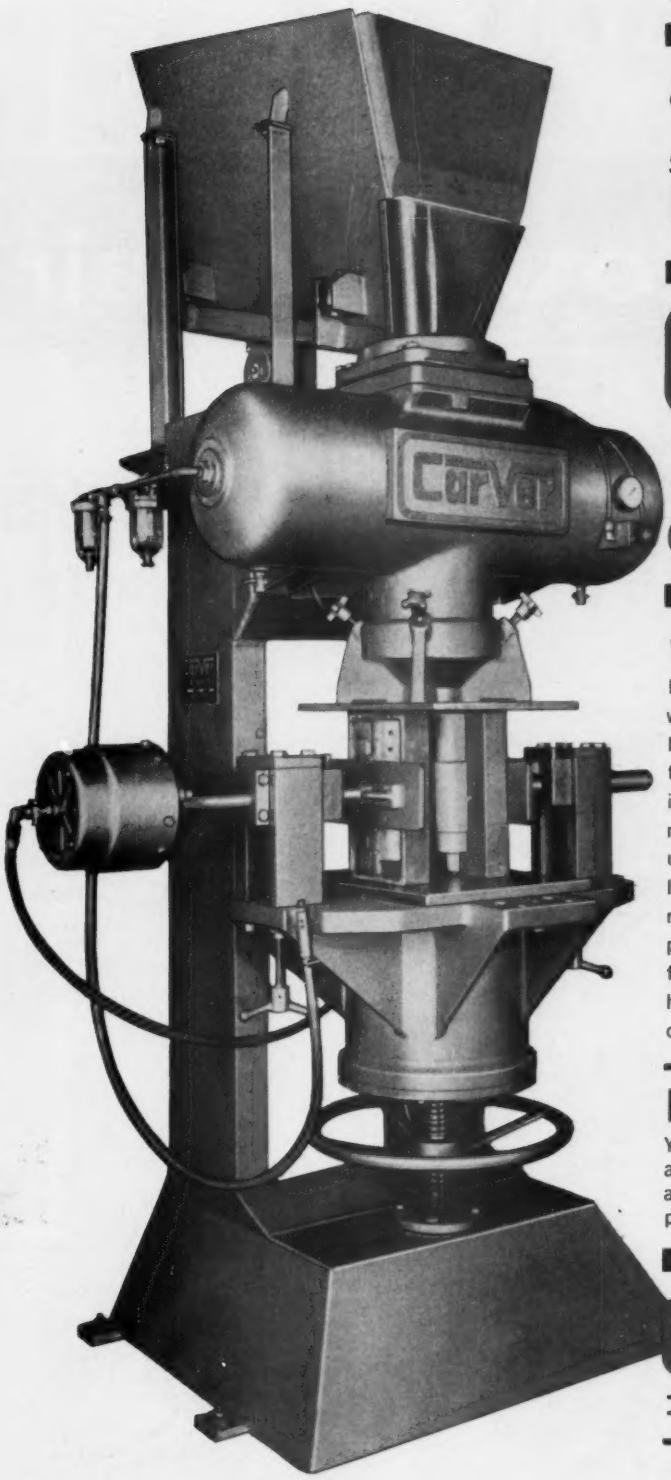
Since 1954, B.F.Goodrich Solarflex belts have been used exclusively on this job. Because of their greater resistance to heat, they last from six to nine months—a 50% increase in belt life.

In this plant, the maintenance supervisor had a good rule which hundreds of others like him follow. Instead of accepting the high cost of frequent replacements, he called in a B.F.Goodrich representative and found exactly what he needed to cut costs and keep the foundry running with fewer shutdowns and delays.

Your B.F.Goodrich distributor has exact specifications for the B.F.Goodrich belt described here. And, as a factory-trained specialist in rubber products, he can answer your questions about the many rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-198, Akron 18, Ohio.*

B.F.Goodrich

CONVEYOR BELTS



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CarVer RAPID CORE SHOOTER

with Changeable Clamping Device

It took years to perfect . . . but you'll agree it was worth it! New Carver Rapid Core Shooter turns out better cores in amazingly fast time . . . without wear to core boxes, metal or wood. New time-saving flexibility with Changeable Clamping Device enables one man to handle complete operation without turning or unnecessary steps. A **rugged**, reliable machine that handles even the most intricate cores. 100% pneumatic operation — push-button controlled. New hopper provides better sand flow. New type cylinder screen for all fineness of sands. Large air reservoir for much harder ram. Fewer working parts keep maintenance costs at a minimum.

PRICED FOR TODAY'S MARKET

You'll like the speed, the accuracy, the versatility, and above all, THE PRICE. Wait till you see it . . . and don't wait too long. In fact, write today for complete information and prices.

CarVer FOUNDRY PRODUCTS
MUSCATINE, IOWA

EVERYTHING FOR THE CO, PROCESS—
Rapid Core Shooter • Rapid Muller • Steinex Binder
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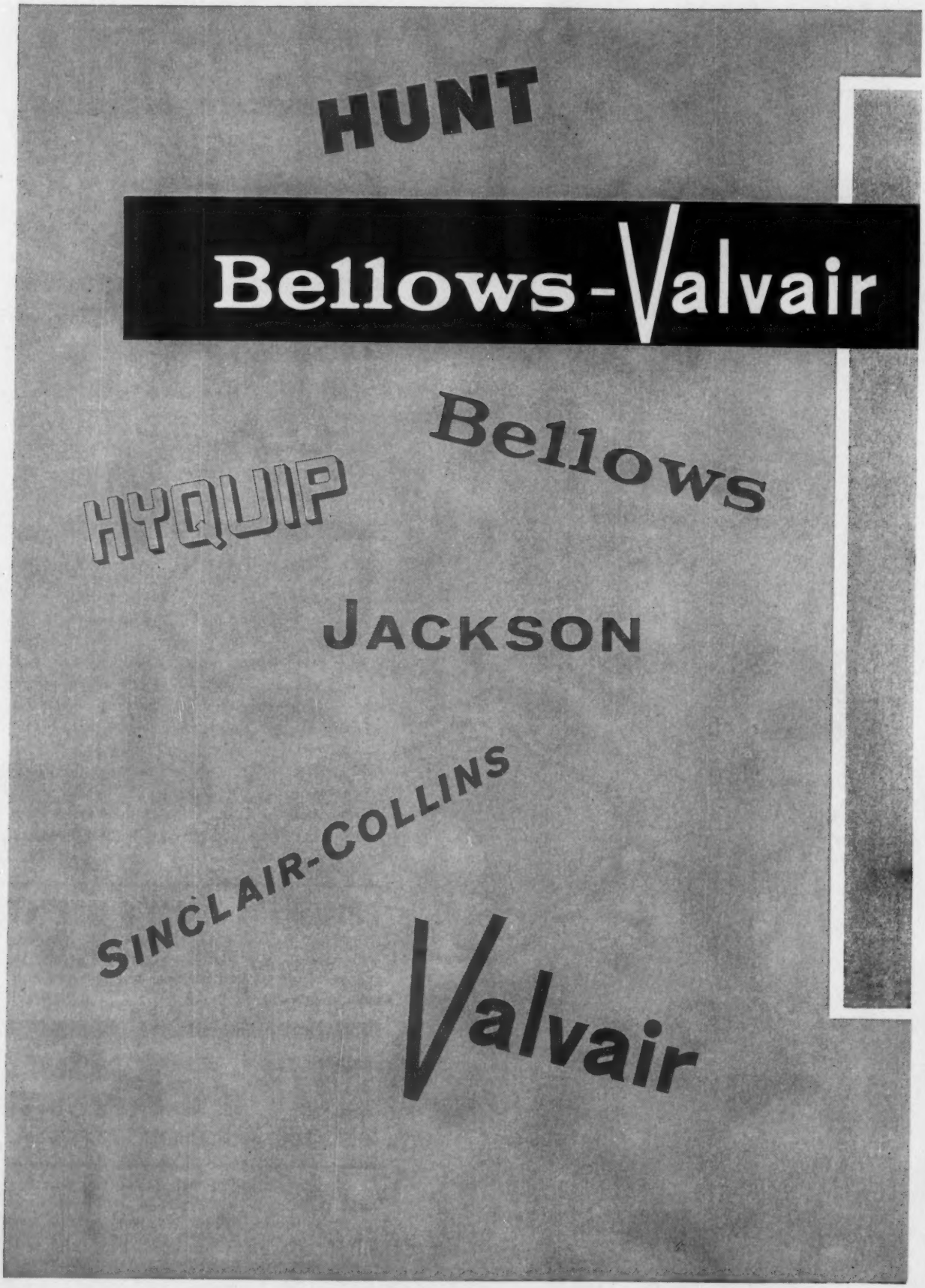
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To make it easier for you to select the most economical combination of related products best suited to your needs . . . to provide you with application engineering recommendations for entire control systems . . . to render unmatched service . . . these sources of specialized products have been combined into one engineering, sales and service organization — Bellows-Valvair.

The Bellows-Valvair Pneumatics Division will engineer, sell and service all Bellows, Valvair and Hunt products involving the use of air. The Bellows-Valvair Hydraulics Division will engineer, sell and service Hunt, Sinclair-Collins and Hyquip hydraulic products, as well as Berry-Dowty gear pumps and motors. The Bellows-Valvair Electronics Division will engineer, sell and service all related electronic devices.

Consolidation of all sales and service under the name Bellows-Valvair combines the knowledge and experience of over 300 design, production and field engineers. The resources of this group are at your service, ready to aid you in the engineering and application of pneumatics, hydraulics and electronics, to solve your production problems.

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New Bulletin FP-62 will give you more information on the divisional product groupings. For your copy, contact the field office near you (listed in the Yellow Pages and Thomas' Register, Volume IV), or write to Bellows-Valvair, Akron 9, Ohio, Dept. FO-1161.

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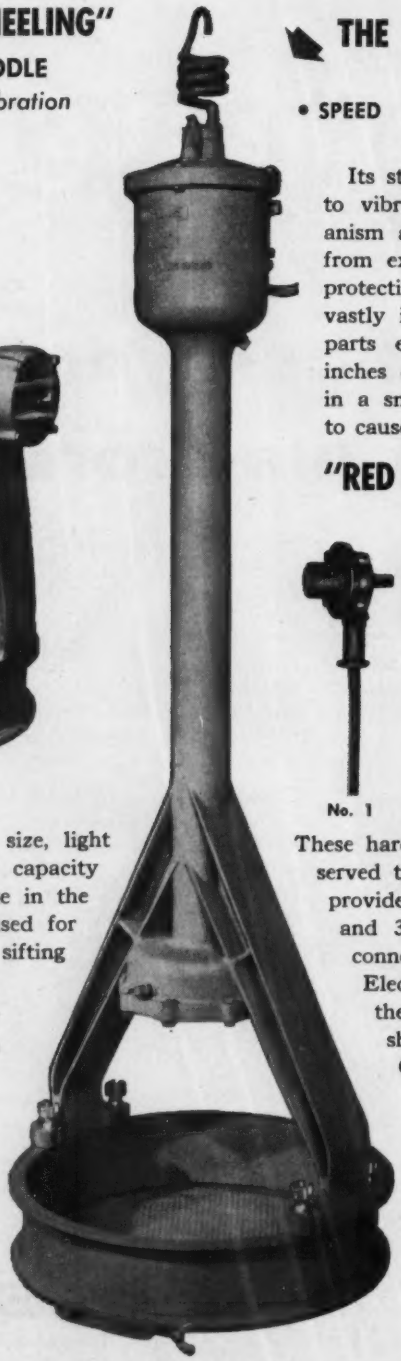
"UNIVERSAL FREE WHEELING"

FOUNDRY SAND RIDDLE

with the Double Eight Vibration



Because of its convenient size, light weight and good riddling capacity it long has been a favorite in the foundry. It also can be used for mixing core sand or for sifting sand directly into molds.

The mechanism is entirely enclosed protecting it from harmful dust and grit.

The main frame is cast in very strong tough aluminum.

It uses quick change ferruled sieves with 20 in. diameter sifting area. There are no loose wires to harm hands.

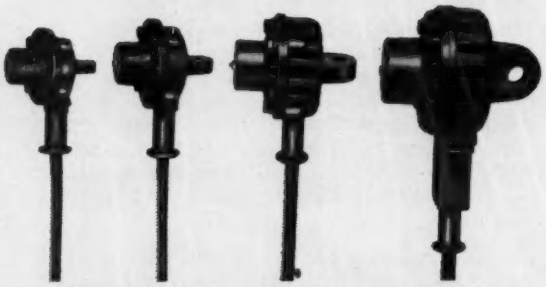
THE "ROTOPLANE" SPEED SIFTER

WILL GIVE YOU

• SPEED • ECONOMY • SAFETY • LONGER LIFE • GREATER SIFTING CAPACITY

Its sturdy one-piece frame and long shaft add to vibration effectiveness. The sealed-in mechanism assures protection of motor and bearings from exposure to dust and grit. This sealed in protection and "Rotoplane's" free-rotary action vastly increase bearing life. No exposed moving parts endanger the operator. Sieves have 20 inches diameter clear sifting area—are mounted in a smooth steel ferrule with no jagged edges to cause dangerous cuts and scratches.

"RED (Devil) ELECTRIC" VIBRATORS



No. 1 No. 2 No. 5 No. 9

These hard hitting Adams designed Vibrators have served the foundries for over 30 years. They are provided with a 6 foot 3 wire authorized cable and 3 wire grounded connector which, when connected with our 3 wire grounded Red Electric Knee Switch, automatically grounds the vibrator protecting the worker from shock. The vibrators have passed the U. S. Government code inspection.

Other Foundry Products:

- **No. 11 NOISELESS TYPE VIBRATOR**
- **A-20 ELECTRIC VIBRATOR**
- **RED ELECTRIC KNEE SWITCHES**
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- **2 MIN. UNIVERSAL FINENESS TEST SIFTER**
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ORDER ALL SIFTERS AND VIBRATORS WITH GROUND WIRE!!

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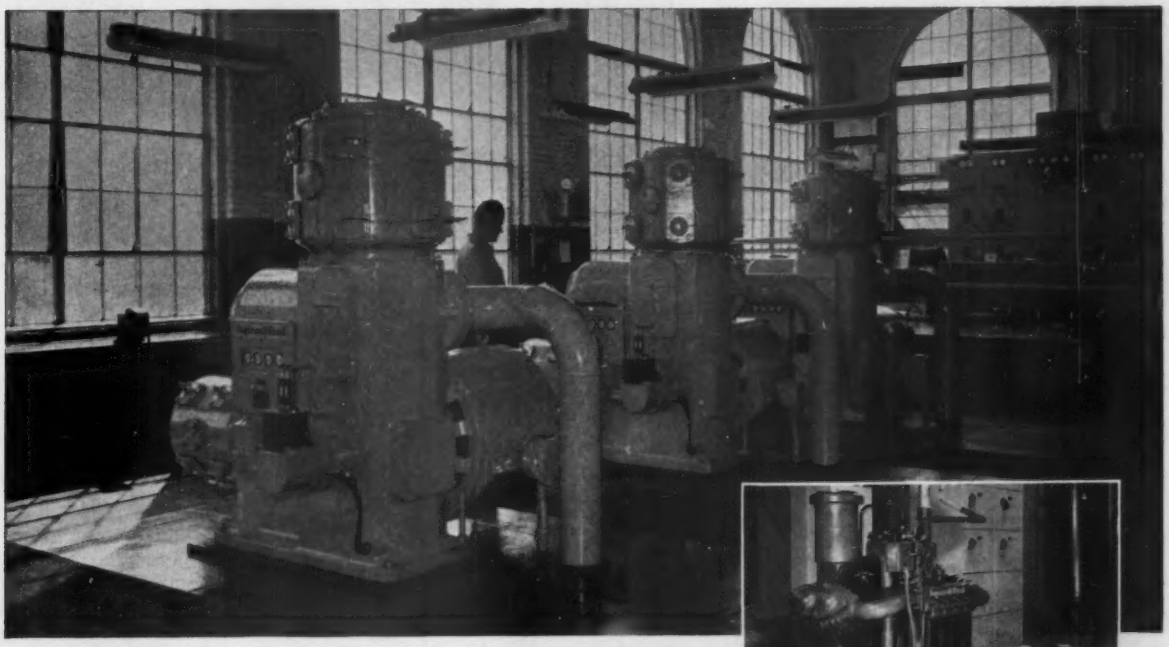
How to squeeze more profits out of your COMPRESSED AIR POWER



Three 125-hp XLE compressors generating air power for a weapons plant. This compact two-stage unit features pipeless Thru-Frame air flow and full-floating aluminum bearings which never need adjustment. Sizes 125 to 350 hp. (Other I-R air compressors to 4000 hp.)

This air-cooled two-stage Type 40 compressor is one of several furnishing plant air and instrument air in a power plant. Sizes 25 to 125 hp. (Others from ½ hp.)

Make sure you have enough pressure at point of use—and extra dependability at point of generation

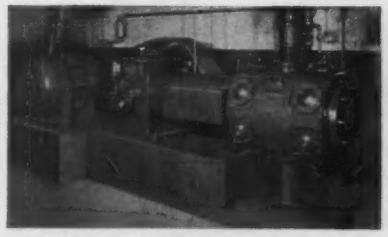
Cost-conscious plant engineers and production men know that to get the full savings inherent with air-powered equipment, you must have full air pressure at every tool.

But it's equally important to guard against unscheduled shutdowns where your air power is generated. This problem can best be solved at the time of purchase, by specifying compressors that have an extra margin of safety against mechanical troubles.

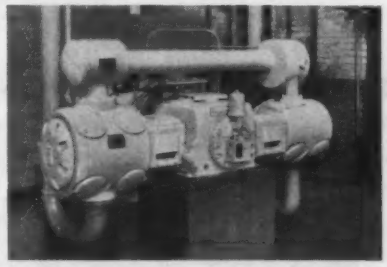
Ingersoll-Rand compressors have that extra safety margin built in. They'll stay on the job longer, with minimum attention and maintenance. Take valves, for example—the most "vulnerable" point in any compressor. Only I-R compressors have Channel Valves, known the world over for efficiency, quiet operation and long life. Their exclusive air-cushioned action eliminates impact and greatly reduces wear.

Also in I-R compressors, all running parts are sealed against dust and dirt which might cause wear. The seal need never be broken, since bearings are a type which will never need adjustment.

For top compressor performance and long-run economy, specify Ingersoll-Rand. And ask your I-R representative to show you how to get your maximum *"Dividend on Payroll Dollars"* with a Planned Annual Review of your air power system.



Ingersoll-Rand's new ESH horizontal compressor, here in a tool factory. Sizes 20 to 150 hp. Also built as vertical unit, called ESV.



Two-stage balanced-opposed PHE compressor handling air in a gas plant. Also built as L-design unit with packaged intercooler. Sizes 75 and 100 hp.

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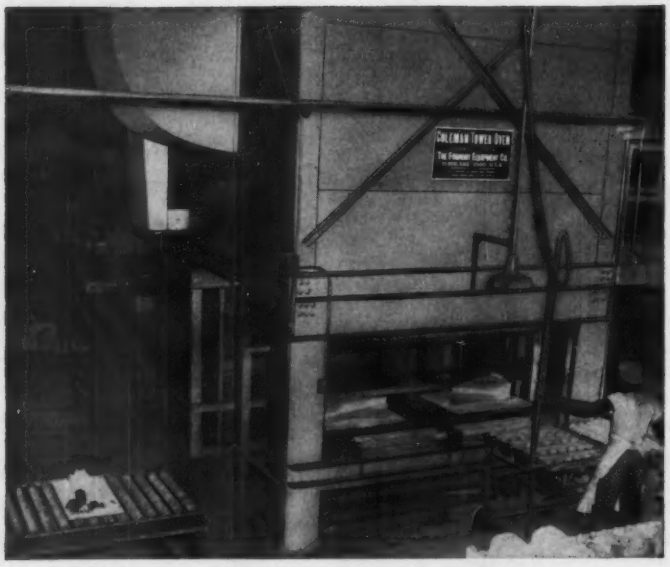
Coleman Dielectric Core Oven in leading plumbing fixture foundry. Direct labor alone reduced by 75%, with many other important savings and advantages.

Coleman Conveyor Core Ovens



Coleman Tower® Core Oven. One of two large installations in a major steel foundry. Mechanized handling and baking of cores up to 150 pounds at substantial annual savings.

● **Performance records in all types of foundries prove that Coleman Conveyor Core Ovens reduce core department costs by as much as 50%!**

Coleman Ovens quickly pay for themselves out of direct savings in labor, materials and reduced casting scrap.

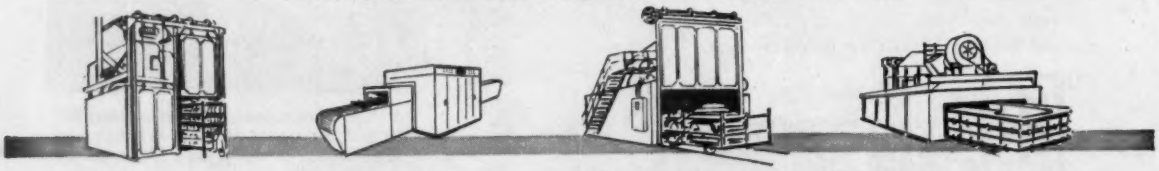
As builders of the world's only complete line of foundry ovens . . . dielectric or recirculating heat . . . we can recommend, without bias, the right oven for your particular needs.

WRITE FOR BULLETIN 54

THE FOUNDRY EQUIPMENT COMPANY • **1821 COLUMBUS ROAD, CLEVELAND 13, OHIO**

World's Oldest and Largest Foundry Oven Specialists—More than half a century of specialized foundry experience.

PART OF THE WORLD'S ONLY COMPLETE LINE OF FOUNDRY OVENS



TRANSRACK OVENS | **DIELECTRIC CORE OVENS** | **CAR TYPE OVENS** | **JET ACTION MOLD OVENS**

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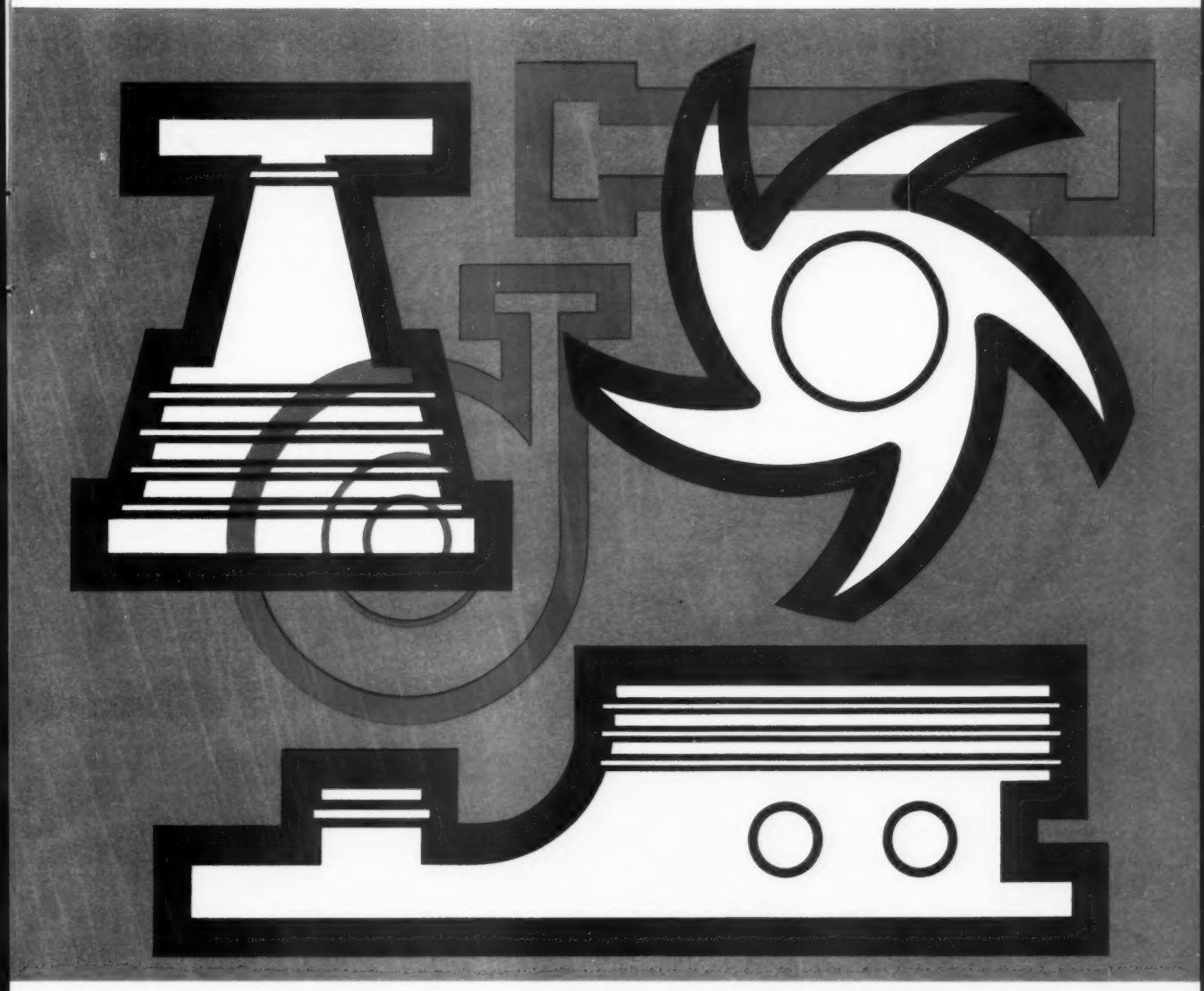


FERROCARBO®

QUALITY CONTROLLED GRAY IRON CASTINGS

SOUND • CLEAN • EASY TO MACHINE

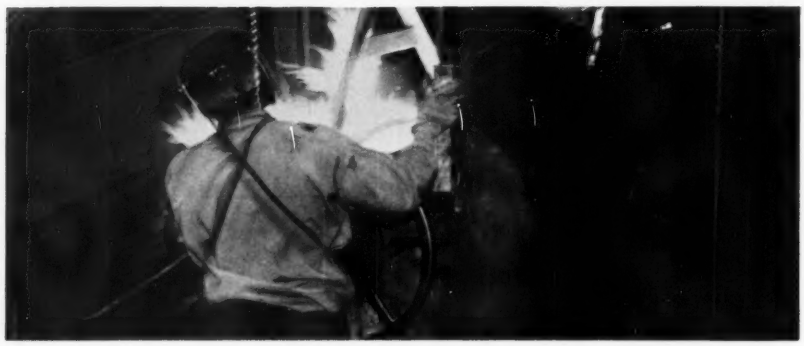
FERROCARBO BY CARBORUNDUM

FERROCARBO-Treated Gray Iron assures

Quality castings can now be produced, through improved structure control, by the addition of Ferrocarbo Briquettes to cupola melted gray cast iron. This unique deoxidizing agent improves cupola melting practices by eliminating many of the casting difficulties of untreated iron. Ferrocarbo-treatment helps reduce costs for the foundry **and** the casting buyer. Misruns and rejects are minimized; fluidity is increased. Castings show improved machinability, and superior physical and mechanical properties.

RAW MATERIAL SAVINGS. The highly reactive nature and reduced chilling tendency of Ferrocarbo-treated iron permits the

FERROCARBO®Keeps foundry costs down, production up



use of more scrap in the charge. Further, the elimination or reduction of other charge ingredients is often possible.

MISRUNS REDUCED. Iron deoxidized with Ferrocarbo is more fluid at casting temperatures than untreated iron. It flows more readily into thin sections or complicated molds. You get better castings . . . fewer misruns. Some foundries report up to 50 per cent reduction in misruns after using Ferrocarbo in the charge.

FERROCARBO®—the only cupola deoxidizer with

stronger... cleaner... more machinable castings

Complete, controlled disintegration of Ferrocarbo Briquettes is accomplished in the melting zone. This means thorough reaction in the cupola providing a consistently uniform operation.

IMPROVED MACHINABILITY. Ferrocarbo-treated gray iron is free from segregations, inclusions and deep, hard, chilled spots. It is more easily machined . . . increases the life of cutting tools up to 35 per cent . . . often permits faster machining speeds.

You can increase the tensile strength of castings for your customers as much as 2,000 to 2,500 lbs. per square inch when you

FERROCARBO® Helps you get and keep customers

treat your gray iron with Ferrocarbo. The castings are finer grained, denser, stronger.

The elimination of graphite, sulphide, phosphide and carbide segregation in Ferrocarbo-treated gray iron removes planes of weakness which cause cracking and wear under conditions of high temperature and friction. In addition, the improved structure provides a better enameling surface.

an expanding agent, a catalyst, and a slag activator

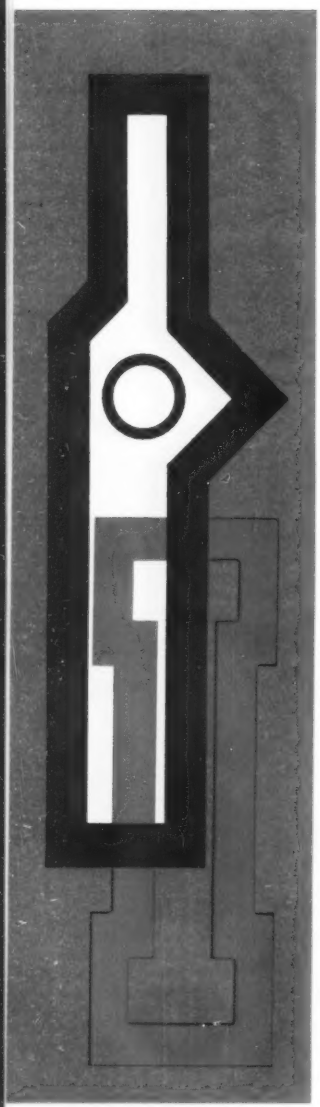
FERROCARBO® BRIQUETTES

SPECIFICATIONS AND PACKAGING

The size and weight of the briquette was established for ease of handling and rapid, accurate calculation of proper percentage of addition. Approximate Size and Weight: 3-1/2" x 4-5/8" x 4-3/4"; 5 pounds.

Available on standard pallets of 24 cartons, 16 briquettes per carton; also, smaller pallets and individual cartons. Waterproof covers and lifting slings as required.

Ferrocarbo Briquettes can be stored indefinitely without deterioration.



FERROCARBO® BRIQUETTES

TECHNICAL COUNSEL

■ Carborundum welcomes your inquiry and offers the assistance of its representatives to help you solve your casting problems. Ferrocarbo representatives are practical foundrymen — usually graduate metallurgists — expertly qualified to assist you in solving your foundry problems and increase your production efficiency — with Ferrocarbo.

■ Complete laboratory facilities are available for scientific evaluation of Ferrocarbo-treated irons from your foundry.

ELECTRO MINERALS DIVISION

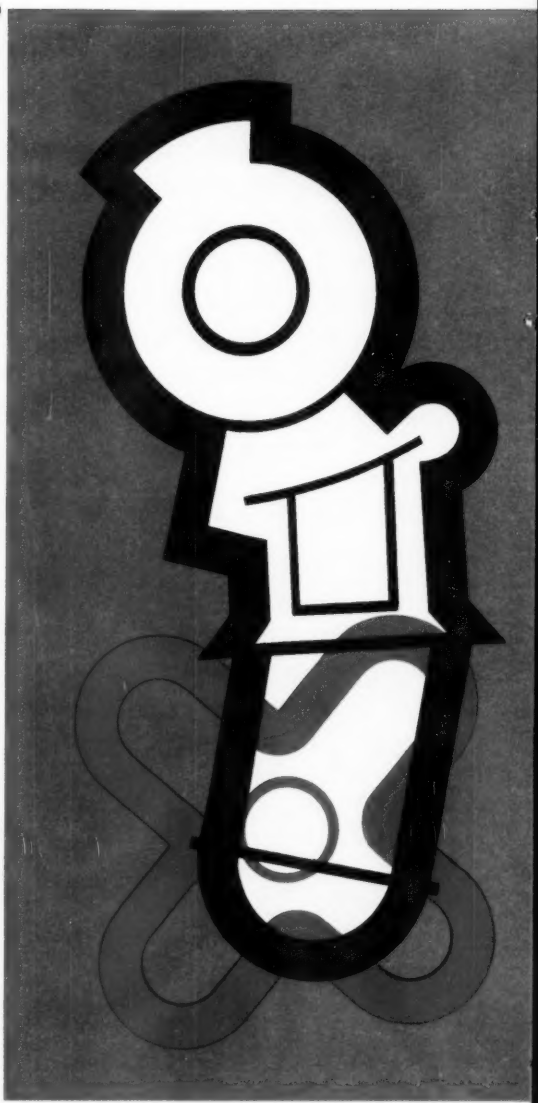
Niagara Falls, New York

CARBORUNDUM

FERROCARBO DISTRIBUTORS

Kerchner-Marshall & Company, PITTSBURGH
Cleveland • Buffalo • Detroit • Philadelphia
Birmingham • Los Angeles • Canada

Miller and Company, CHICAGO • St. Louis
Cincinnati • Kansas City, Mo. • Burlington, Ia.



Knight LETTER

NINTH IN A SERIES

To: Foundry Management

Subject: Periodic Engineering Survey

An impartial audit of operations points out where and how a foundry can strengthen its competitive position and more fully utilize its man power and productive capacity.

The rapid development of improvements in techniques, methods and machines means that a foundry considered modern ten years ago may be out of date today. Drawing on the wide experience gained from hundreds of assignments in the foundry field in the United States, Canada, Europe and South America, Knight Engineers are particularly well qualified to help you determine which of the new procedures and equipment can be utilized profitably in your foundry. As professional engineers we are concerned with practical, economical solutions—not influenced by other responsibilities to management or an interest in equipment sales.

A Knight Survey can be helpful to your foundry operation. For further information write or call any of the offices listed below.

Lester B. Knight

KNIGHT SERVICES INCLUDE:

Foundry Engineering • Construction Management • Modernization • Mechanization • Automation • Survey of Facilities • Materials Handling • Methods • Industrial Engineering • Wage Incentives • Cost Control • Standard Costs • Flexible Budgeting • Production Control • Organization • Marketing

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Management Consultants, Industrial and Plant Engineers

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New York Office—Lester B. Knight & Associates, Inc., Management Consultants, 500 Fifth Ave., New York 36
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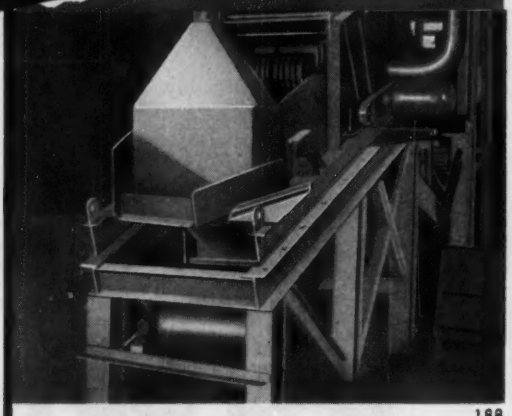
SALVAGE YOUR VALUABLE MOLDING SAND with a SIMPLICITY RING-TYPE CRUSHER SCREEN



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You profit two ways with Simplicity's Ring-Type Crusher Screens

- Your used core and molding sand is crushed and screened for re-use in one operation, saving the cost of new sand .
- Transportation and dumping costs of used sand are eliminated.

This unit combines the Simplicity heavy-duty vibrating screen with free-turning cast rings mounted over crushing plates. One to three sets of rings can be supplied, depending upon the maximum lump size to be crushed.

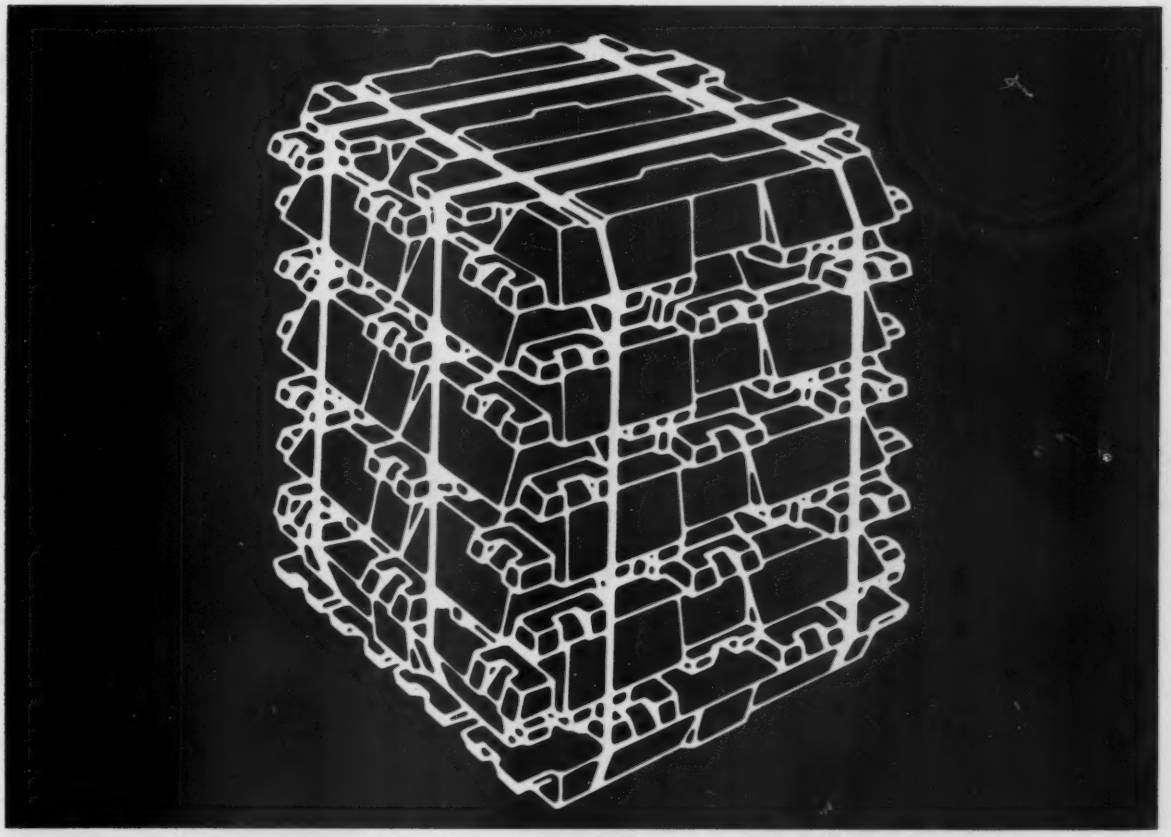
Simplicity ring-type crusher screens are paying their way in foundries producing magnesium, steel, malleable and grey iron castings throughout the United States.

Available in many models and sizes. For complete information write today for the name of our sales engineer in your area; and turn your waste into profits.

SALES REPRESENTATIVES IN ALL PARTS OF THE U.S.A.
FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario.
FOR EXPORT: Brown and Sites, 50 Church Street, New York 7, N. Y.

Simplicity
TRADE MARK REGISTERED

ENGINEERING COMPANY • DURAND 7, MICHIGAN



Are You Up to Date on Aluminum Casting Ingot?

Looking for new casting alloys and applications is a daily job at Alcoa, where almost all of today's alloys were created. Latest developments from Alcoa research in aluminum casting ingot:

New Alloys! X359 for premium-quality castings: higher strength than A-356 and the old stand-by, 356. X385, a die-casting alloy for bearing applications. X392, a high-silicon alloy with excellent resistance to wear. 364 for the best combination of castability, strength and ductility available in die-casting alloys.

Improved Quality! Alcoa® Induction Furnace Grade Ingot, introduced recently, cuts down deposits in channels. *Really* clean, fewer oxide particles that clog furnaces, and less skim. Alcoa I.F.G. Ingot means fewer shutdowns, better product quality. Yet it costs you *no more!*

Better Packaging! Alcoa's interlocking 50-lb ingot makes bundles tighter, more compact. You unload them faster; move them quicker and more safely; stack them higher. Available in standard cross-stacked bundles or low-silhouette, parallel-stacked bundles.

Keep up to date in what's newest for the foundry from the leader in aluminum. Call your Alcoa sales office today or mail coupon!

Free Alcoa Casting Alloy Ingot booklet! Send today!

Aluminum Company of America
863-L Alcoa Building, Pittsburgh 19, Pa.

Please send *free* booklet on Alcoa Aluminum Casting Alloy Ingot.

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Alcoa Aluminum Ingot is refined, clean, pure . . . sound, uniform and customized

Entertainment at Its Best . . . **ALCOA PREMIERE** with Fred Astaire as Host . . . Tuesday Evenings, **ABC-TV**

ALCOA ALUMINUM

INGOT

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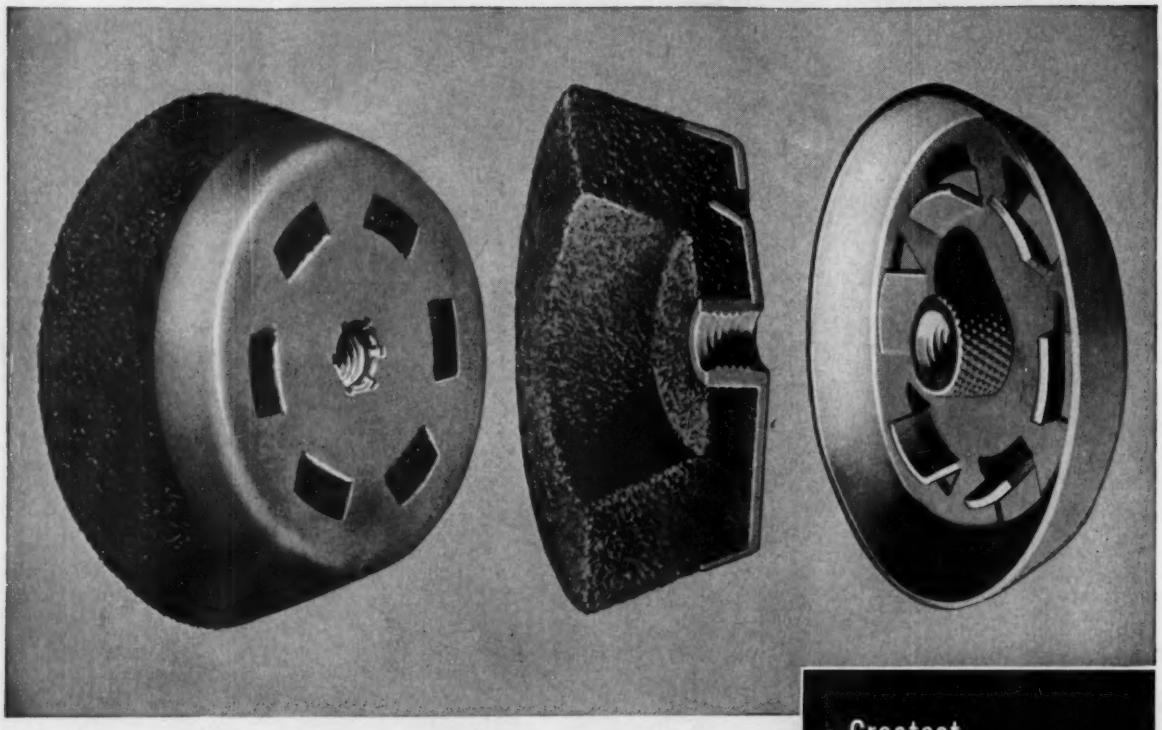


MANHATTAN

THE ORIGINAL *SAFETY BACK* FLARED CUP

The first wheel to offer the exclusive features of the Safety Back Flared Cup! This totally new concept of design *and* construction puts portable wheel *safety* where it counts the most — in *original* strength and breakage resistance! With Safety Back, steel covers the entire back of the flared cup . . . extends down the side to assure a degree of reinforcement never before available with anchor bushings, safety rings, special hub mountings or ordinary revolving cup guards.

You can't get a safer wheel to use . . . and you can't find a better performing wheel to use on your portable grinders. Every Manhattan Safety Back Flared Cup is custom-bonded with the right abrasive for *faster* removal of *more* metal on your particular job — at no extra cost!

For faster cutting, longer lasting, *safer* abrasive wheel performance — "More Use per Dollar" — be certain you get the original Manhattan Safety Back Flared Cup. Let your Manhattan abrasive wheel engineer show you the exclusive advantages of this and other Manhattan high speed, heavy duty abrasive wheels. Write for Bulletin 7157.

- Greatest Initial Strength
- Easy Mounting — Easy Operation
- Highest Safety Factor
- Requires No Adjustment
- One Piece Assembly
- Improved Mounting Base

"MORE USE PER DOLLAR"

ENGINEERED RUBBER PRODUCTS . . . MORE USE PER DOLLAR

RM

RM 1060

WRITE TO ABRASIVE WHEEL DEPARTMENT

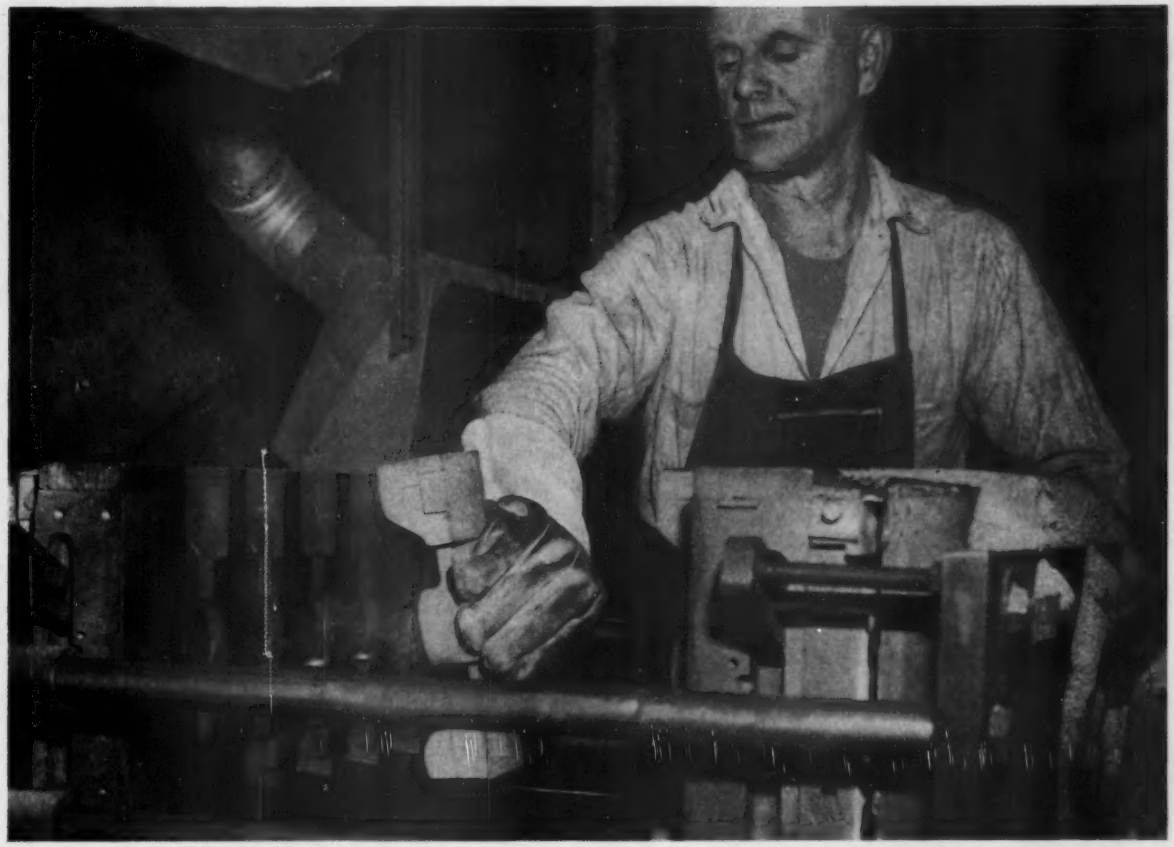
MANHATTAN RUBBER DIVISION • PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

For More Information Circle 600, Page 39

SILICONE NEWS from Dow Corning

Here's a clean breakaway



Speed shell core production, cut scrap...with silicones

Shelve your sticking problems permanently by using Dow Corning 8 silicone emulsion. Just a light coating on patterns gives instant release of resin-sand shell cores and molds. You eliminate stickers and assure yourself of clean release, retention of detail, close tolerances. With silicones you also enjoy the lowest maintenance and replacement costs.

The silicone release coating obtained with Dow Corning 8 resists heat . . . doesn't flash off or evaporate at mold curing temperatures . . . doesn't carbonize. Build-up on patterns is kept to an absolute minimum. Patterns stay clean many cycles longer — you may even find fewer are needed.

Easy does it. Simply mix Dow Corning 8 Emulsion with water . . . in the ratio most suitable for your process and in the volume most practical for your production schedule. Then apply the mix by dip, brush or spray.

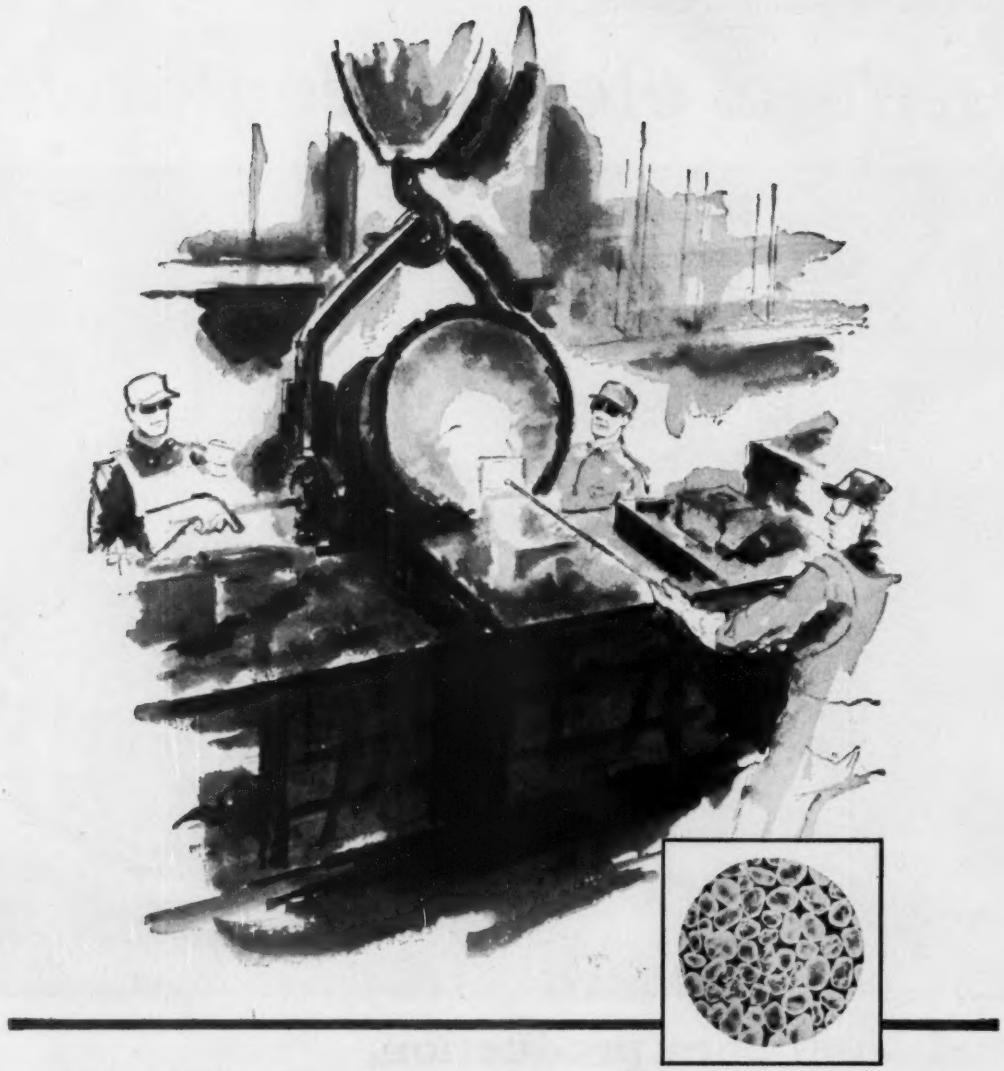
The emulsion's stability and fast wetting action produce a uniform film that gives overall, easy release and provides excellent surface finish.

Technical service . . . fast delivery! Continuing research and development in silicone chemistry means that Dow Corning always offers the newest and most effective silicone products at lowest possible price. Phone or write for prompt technical assistance or for fast delivery from fresh warehouse stocks.

For FREE booklet on "How to Use Silicone Parting Agents in Shell Molding," write Dept. 5123, Dow Corning Corporation, Midland, Mich.

first in silicones

Dow Corning



ALL THE MERITS OF ROUNDED-GRAIN QUALITY ARE YOURS WITH WEDRON SILICA...

We feel the name Wedron means a number of things to foundrymen: Quality, purity, rounded-grain structure, and a wide range of A. F. S. grades to choose from. Of these, quality and the rounded-grain advantages stand out. They tell you that Wedron Sands give you the basis for better controlled castings. Try Wedron today and experience better results.

WEDRON SILICA COMPANY

135 South LaSalle Street • Chicago 3, Illinois

Send for illustrated brochure on Wedron sands.

MINES AND MILLS IN THE WEDRON-OTTAWA DISTRICT

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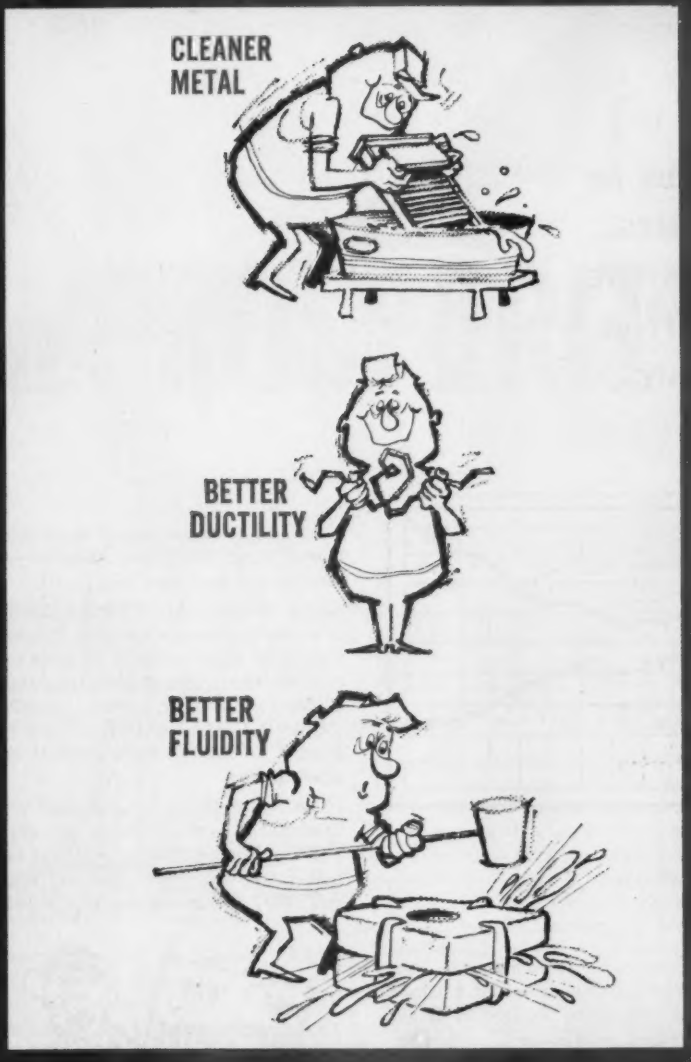
LOOK WHAT CALCIUM ALLOYS CAN DO

for steel foundries...



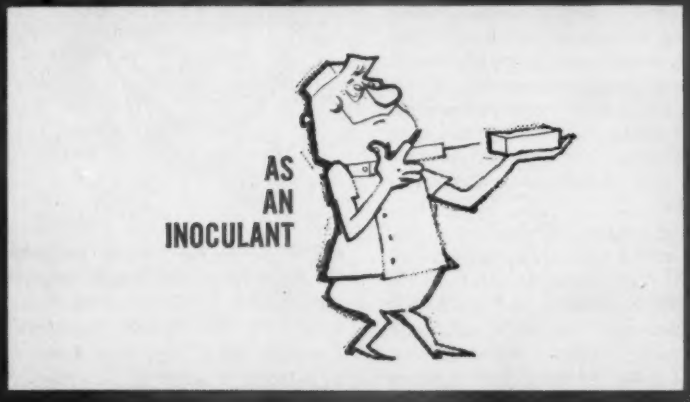
Ohio Ferro-Alloys' calcium alloys are beneficial in the production of quality steel and iron castings.

Steel foundries find the deoxidizing and degassifying effects of calcium-silicon and calcium-manganese-silicon produce cleaner castings. Undesirable inclusion types are greatly reduced or eliminated.

Cleaner metal results in better properties for steel castings. Marked improvements in ductility and impact properties have been widely noted.

Calcium treated cast steel exhibits improved fluidity. For consultation on how calcium-silicon and calcium-manganese-silicon may help your castings, contact our Foundry Service Department.

for iron foundries...



In cast iron, too, the calcium alloys help produce better castings. Inoculation of gray cast iron with calcium-silicon prevents chilled edges and improves machinability.

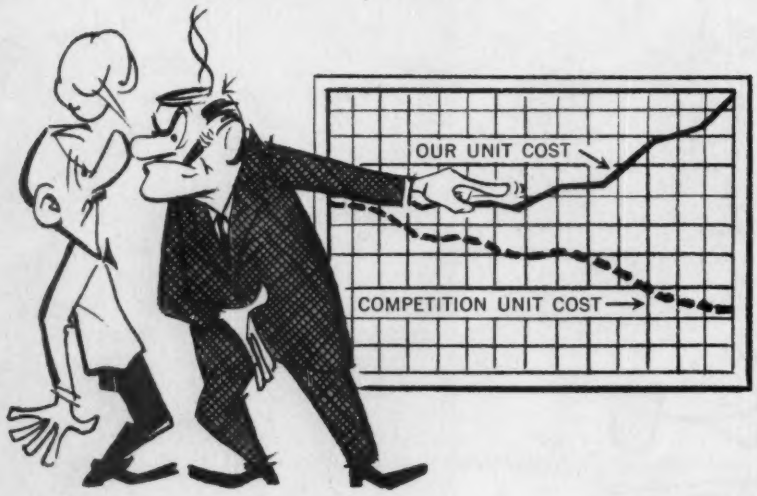
QUALITY SERVICE DEPENDABILITY

Ohio Ferro-Alloys Corporation
Canton, Ohio

BIRMINGHAM • BOSTON • CHICAGO • DAYTON • DENVER • DETROIT • HOUSTON • KANSAS CITY • LOS ANGELES • MINNEAPOLIS
PHILADELPHIA • PITTSBURGH • ST. LOUIS • SALT LAKE CITY • SAN FRANCISCO • SEATTLE • VANCOUVER, B. C.

IT'S A FACT... BUSINESS FAILURES DURING 1961 WILL BE AS HIGH AS NEW-BUSINESS-STARTS! THIS PHENOMENON INDICATES THE PRESENCE OF A NEW COMPETITIVE TWIST IN OUR RISING ECONOMY!

SURVIVAL



● SURVIVE! . . . is the basic command issued by the stock holders of a great many metalworking organizations. This is especially true in the *foundry industry* . . . because competition here is reaching an all-time high. It is the product of the foundry that signals "first costs" and these costs receive management's maximum scrutiny.

The problems involving SURVIVAL in the foundry industry are more complex each day . . . but it should be pointed out immediately that there are solutions to most of these "death dealing" factors. If your company can produce a product unit (of specified quality and quantity) at a competitive price and you are in trouble, your problems are probably related to sales ability.

If you find it difficult (or impossible) to match price . . . your problems concern operating costs, and these reflect production ability as well as administrative overhead. (Remember . . . the overhead burden attached to each product unit can be reduced by means of increased production . . . production that is fast and economical.)

Let's deal, at this time, with a foundry that cannot beat the competition's price and delivery schedule. It is a cruel fact . . . such a company won't last long even in a prosperous economy. Now let's examine the production facilities of this organization. If the equipment is seven or more years old . . . no matter how well it has been maintained . . . the production ability of this foundry is economically obsolete!

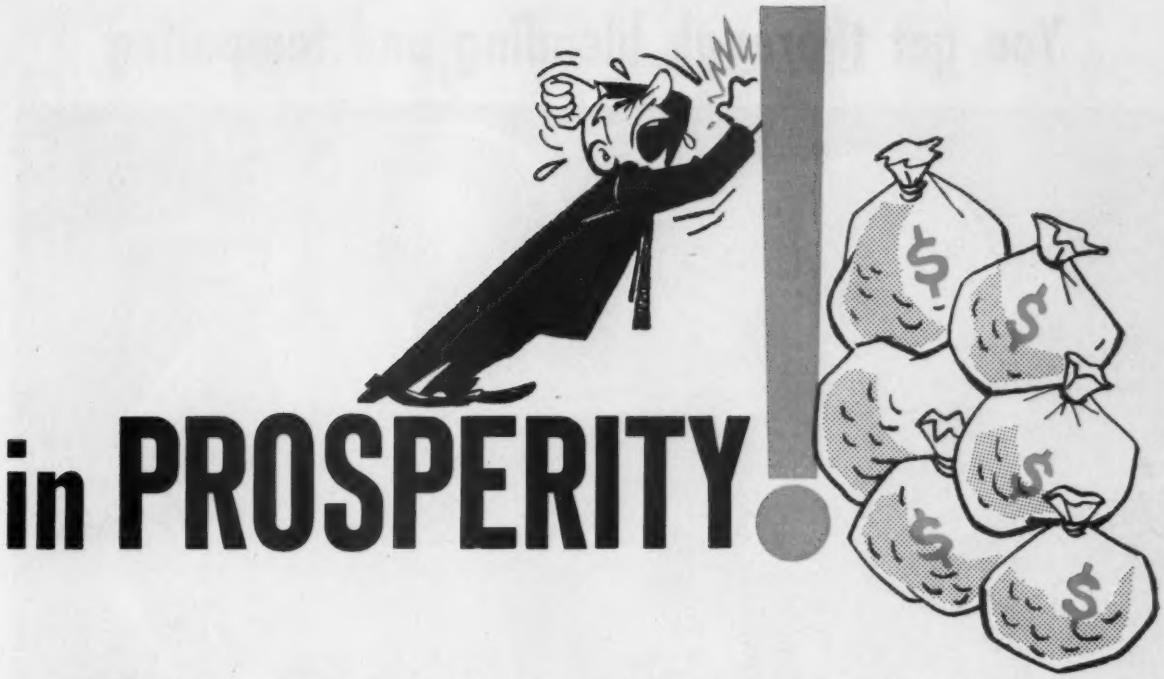
Fast and economical production (together with a well trained sales force) will generally provide the hard-hit foundry with stimulus and profits. Rebuilt machinery may be brought back to original "ability", but these machines are still no match for the newer semi and fully automatic equipment that is establishing new *highs* in production and new *lows* in cost.

And so SURVIVAL in PROSPERITY is a new experience for most business men. The large continue to grow . . . and the small will grow smaller UNLESS THEY MEET THE COMPETITIVE CHALLENGE with a re-gearing of production facilities and sales impact.

NOW! . . . is the time to channel your thinking in the direction of *grow!* NOW! . . . is the time to invest in new high-speed equipment that will make you the *"competitor-to-be-watched."*

NOW! . . . is the time to re-examine the *high-cost of short-range economies* and to look at the advantages to be gained through *modern equipment!*

Consider these important facts. Our population is growing . . . growing at

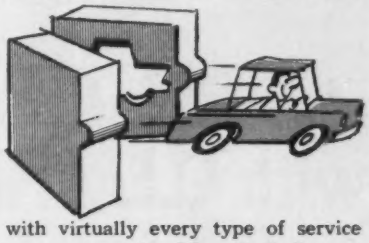


in PROSPERITY!

an unprecedented rate. This will mean more products of every conceivable type. What's more, additional product components are being changed to cast-production. (Recent news stories indicate that several automotive manufacturers have scheduled connecting rods, crank shafts and cam shafts for foundry production.) Your potential is greater today than ever before. Be sure that your company becomes a working part of our economy in the decade ahead and not a monument dedicated to today's errors of judgment.

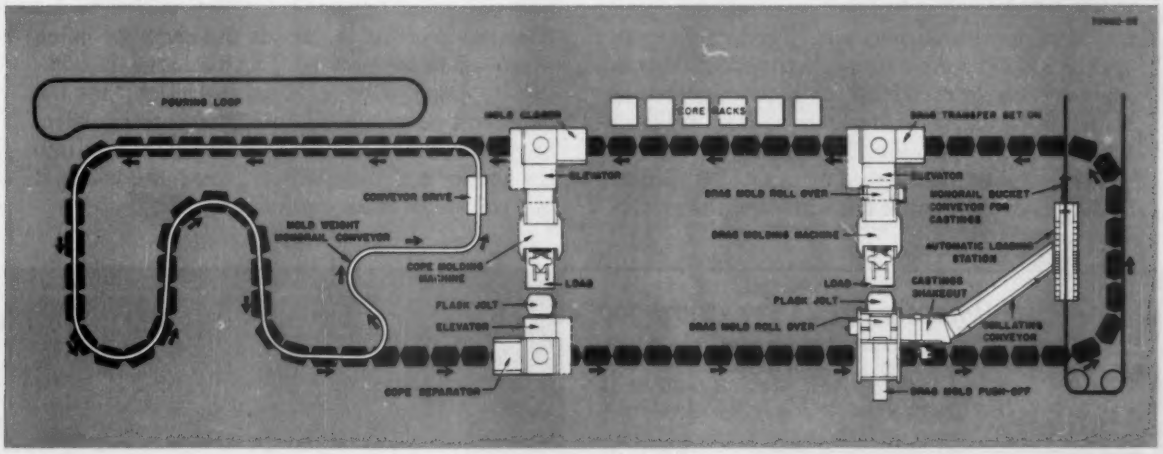
If your move now is for modern equipment, remember that old buying habits, like old machines, can cost you your chances of survival. We urge you to investigate the production engineered equipment being created by SPO, Inc. (The diagram below shows a newly installed automated foundry designed and installed by SPO's creative engineers.)

Today, SPO is the world's leading supplier of foundry molding machines and ancillary equipment. Our research and design facilities are second to none, and our field engineers stand ready to provide your organization

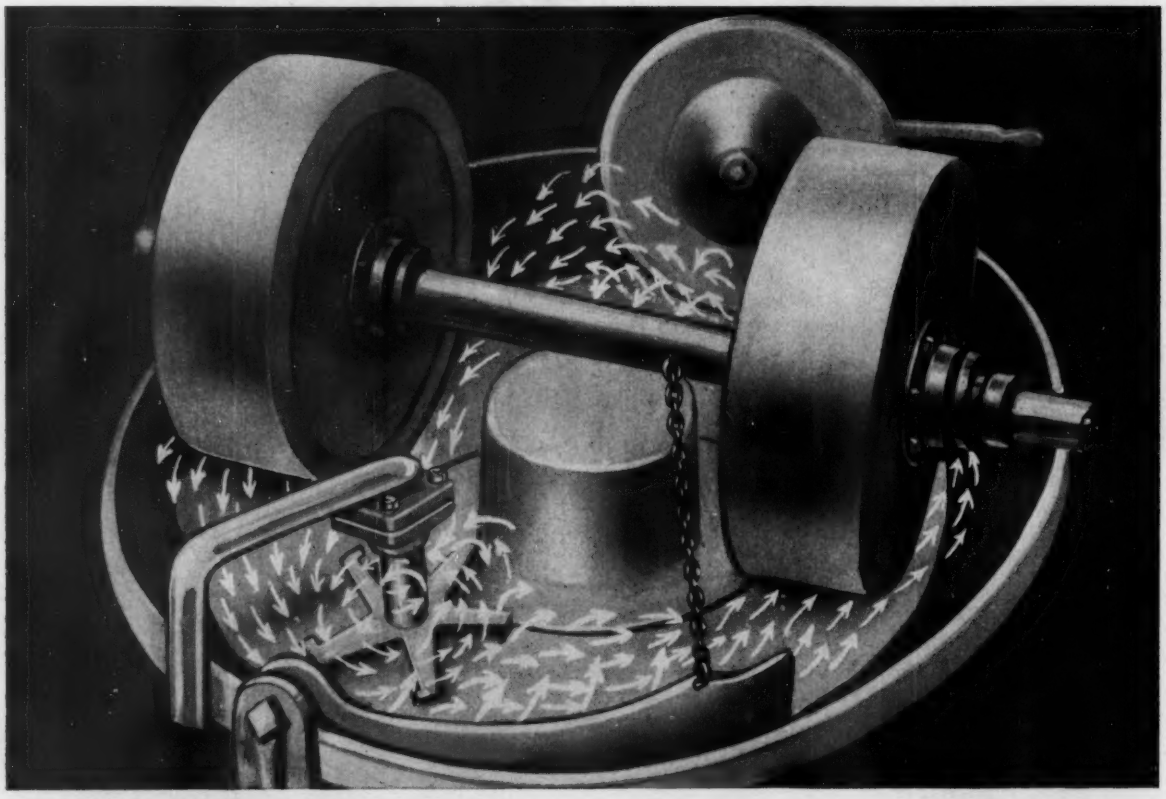


with virtually every type of service you may require. We will gladly provide you with technical information and offer our suggestions and you will be under no obligation. May we suggest you contact SPO.

SPO INCORPORATED
6449 Grand Division Avenue,
Cleveland 25, Ohio, U.S.A.
Call Diamond 1-3666.



You get thorough blending and tempering



with CLEARFIELD "Revolving Pan" MIXERS

All Clearfield Mixers work on the revolving pan principle, providing a balanced mixing and tempering action. As the pan rotates, centrifugal force keeps *all* of the batch in continual motion, adding to the mixing action of the mullers, agitator and revolving disc. There are no lags.

The mullers of Clearfield Mixers not only revolve on contact with the mixture, but also exert a sliding, twisting action which rubs or "smears" the bond on the sand grains, increases the speed and thoroughness of tempering. These mullers are wide faced and spread far apart to give maximum mulling area per revolution . . . high production is achieved without excessive pan speeds, reducing vibration, prolonging life of the machine.

The patented star-shaped agitator of Clearfield Mixers covers the entire flat surface of the revolving bottom and prevents the material from forming hard cakes or lumps. The agitator is driven by contact with the revolving bottom or the material being mixed. The whirlpool action created by the agitator speeds up the mixing process, promotes clean emptying of the pan.

A double duty disc cuts all the material free from the revolving pan rim at each revolution, turns it over and diverts a continuous stream of material under the mullers. When moved to the discharge position it unloads the complete batch within 15 to 30 seconds! This discharge, in addition to being smooth, rapid and clean, has the important advantage of having an aerating effect because it shoots the sand out over the rim into the hopper in a finely diffused spray, depositing it in a soft fluffy condition ready for use.

There's a size for every job

Clearfield Mixers are available in sizes from 2½-ft. to 9-ft. diameter . . . with capacities per batch ranging from ½ cu. ft. to 40 cu. ft. For details write for free technical bulletins.

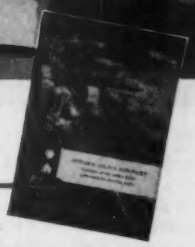
CLEARFIELD
MACHINE COMPANY
CLEARFIELD
PENNSYLVANIA, U.S.A.

OTTAWA Round-Grain SILICA

...BETTER 4 WAYS

- Excellent flowability
- Low bond requirements
- High permeability
- Cleans easily–no breakdown during reclamation

Write today for your free copy of OTTAWA'S new brochure



99.9% pure SILICA

Serviced by truck, barge and two main trunk railway systems, Ottawa Silica offers fast delivery to all corners of the nation.

OTTAWA SILICA COMPANY
OTTAWA, ILLINOIS
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Standard Silica Co., Ottawa, Ill.
Michigan Silica Co., Rockwood, Mich.

For More Information Circle 606, Page 39

Mr. P. Lasken, Quality Control Manager, Hills-McCanna, Chicago, Illinois states: "Intricate castings are our life blood, and this is why we have standardized on the Cardox CO_2 core and mold hardening process. Now that our molds and cores are hardened right in the flasks and core boxes, casting tolerances finer than those normally attained by other sand casting methods are now practical. Such precision not only permits us to meet the customer's specifications to the letter but also sharply reduces our costs. In order to meet the continuing demands by the Space Age Industry for state-of-the-art improvements, methods such as the CO_2 process are extremely important to us at Hills-McCanna."

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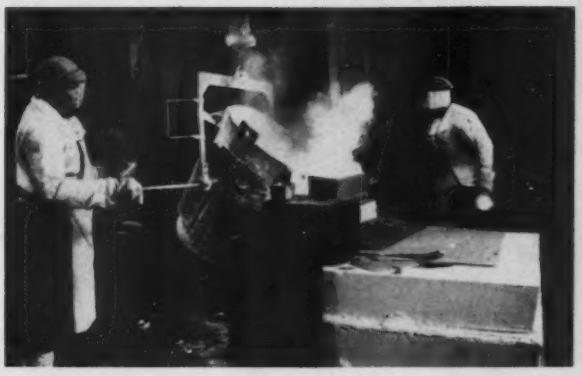
"There seems to be no end to the economies and increased productivity Cardox CO_2 has brought to our core and mold making operations. What used to take hours to form and dry can now be prepared in a matter of minutes without baking. No core dryers are needed, and our pattern costs have been sharply reduced. Cardox CO_2 also takes the guesswork out of back drafting...if a CO_2 mold can't be drawn, we know more back draft is needed."



"Because CO_2 hardening has so markedly reduced our make-ready time, we are now able to provide service on rush orders never before possible. Lead time to produce finished molds and cores is now cut to a minimum. Another important feature of CO_2 hardened molds and cores is the fact they do not absorb moisture, and this has substantially reduced our scrap factor."

"Our use of CO_2 doesn't stop with the core room, we also find it useful in the solution heat treatment of our aluminum and magnesium castings. Cardox CO_2 is piped directly from the bulk storage tank to each oven where precise regulation assures close control of the oven's atmosphere. I might add Cardox keep-full service is most dependable and much appreciated."

CARDOX

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For More Information Circle 607, Page 39

NOW...ONE WASH...

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FOR ALL TYPES OF CORES

Surface penetration study reveals a single water-soluble graphite wash* can be used successfully in ferrous foundries on resin-shell, oil-sand and silicate-bonded sands.

These photo-micrographs illustrate the adaptability of VELVA-PLAST GWA-2. Note the varying degrees of penetration into different types of core and mold surfaces, depending upon the composition of the solvent. This unique water-activated coating is exceptionally compatible with alcohol (up to 20% of the weight of the solvent), which materially affects penetration, bonding and drying characteristics.

VELVA-PLAST GWA-2 is an effective refractory at pouring temperatures up to 2800° F. With controlled penetration, inclusions in the casting can be eliminated. Peel is sure, thorough, clean. The new wash remains in suspension and will not settle out. VELVA-PLAST GWA-2 can be applied by swabbing, spraying, or dipping, and is an excellent filler resulting in exceptionally smooth core surfaces.

RESULTS: Regardless of your core composition, you get clean, smooth casting surfaces without a trace of burn-on, and free from penetration defects.

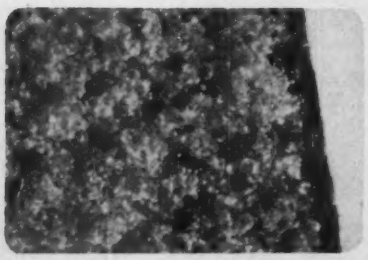

Fig. 1. SHELL CORE coated with VELVA-PLAST GWA-2 mixed with water.

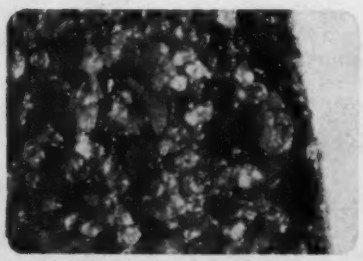

Fig. 3. OIL-SAND CORE coated with VELVA-PLAST GWA-2 mixed with water.

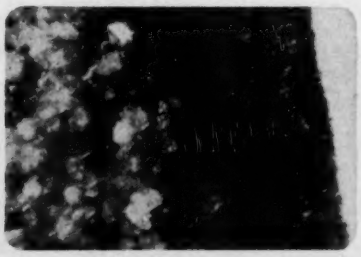

Fig. 5. SILICATE-BONDED CORE coated with VELVA-PLAST GWA-2 mixed with water. Penetration is adequate without use of alcohol.

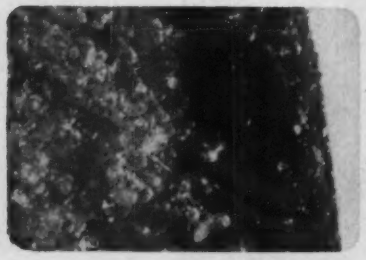

Fig. 2. SHELL CORE coated with VELVA-PLAST GWA-2 suspended in a solution of 80% water and 20% alcohol. Addition of alcohol aids wetting of waxy surface and assures deeper penetration of the wash.

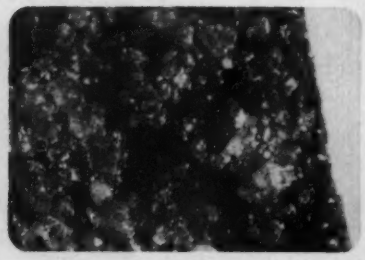

Fig. 4. OIL-SAND CORE coated with VELVA-PLAST GWA-2 suspended in a solution of 80% water and 20% alcohol. Penetration of water-borne wash into surface of oil-sand core is adequate in many instances, but the addition of alcohol speeds up drying of wash.

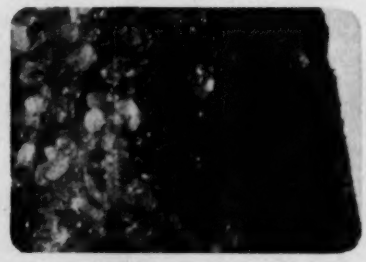

Fig. 6. SILICATE-BONDED CORE coated with VELVA-PLAST GWA-2 suspended in a solution of 80% water and 20% alcohol. The effect of alcohol is evident but would not be required in this case.

* New graphitic refractory wash developed by the ADM Foundry Research Laboratory

Archer-Daniels-Midland

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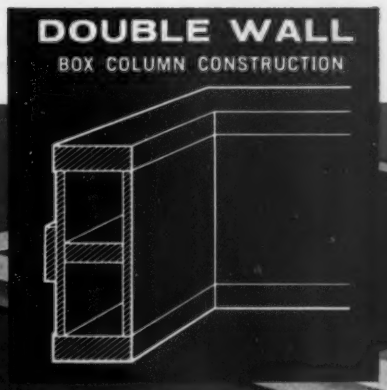

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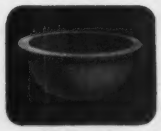

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For More Information Circle 610, Page 39

READERS' COMMENT

Article's Summary Misleading

To THE EDITORS:

I read with some interest the paper by DeSy and Van Eeghem entitled "Machinability of Gray Iron" on Page 78 of the September issue of FOUNDRY.

The work of Eastwood, Bonsu, and Eddy in the paper on "Copper in Cast Iron," *Transactions*, AFS, 1936, Page 51 et seq., shows that copper increases the chill and carbide-forming tendencies of cast iron when Si is 2.0 per cent or over and has chill-reducing effects only with Si at 1.50 per cent or less. Thus, the summary by DeSy and Van Eeghem that copper is a graphitizing element during solidification is grossly misleading.

Considerable of the engineering gray irons contain 1.8 to 2.5 per cent Si so the summary statement should be confined to the copper irons tested—in this case, irons with 1.63 per cent Si or less—to prevent misleading conclusions.

Also in the summary, I take strong exception to the second to last paragraph which states "to a lesser degree, nickel may produce the same effect." Their data do not include nickel cast irons and there is plenty of experience to show that nickel is more effective in carbide prevention than copper at any silicon level and it remains effective in chill reduction over all silicon levels in gray iron.

In any technical paper all statements and conclusions should be limited to the area of the investigation. Under no circumstances should wide, sweeping statements be made from limited data.

F. G. SEFING
Supervisor, Foundry Products
International Nickel Co.
New York

Reprints Prove Valuable

To THE EDITORS:

This is to thank you for your letter of July 1, 1961, and the two packets containing the articles on shell molding which were received subsequently. The reprints of articles on the subject published from time to time in your valued journal FOUNDRY that have been sent to me in order to aid me in my research work have really proved very valuable.

This service of supplying the reprints free of cost to your various readers is essentially a very encouraging tradition that need be followed by all the technical journals. The service is in itself really exemplary. The readers of your esteemed journal, in turn, owe a great deal to you for the wonderful services.

I do not know how to express my deep gratitude for the interest you have shown in research work being carried on in a country far far away and gone all the way to help the cause.

Thanking you very sincerely once again.

V. A. GADGIL
Lecturer in Process Metallurgy
College of Engineering
Poona, India

Sand Symposium Useful

To THE EDITORS:

We have seen the October issue of FOUNDRY and want to tell you that the six topics of the sand symposium are very timely and educational.

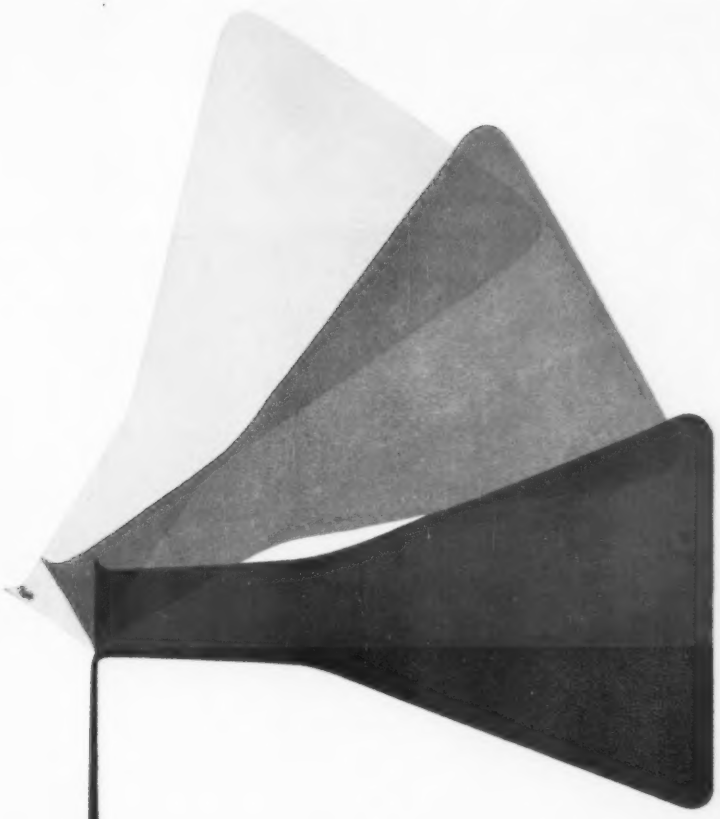
We believe that the foundrymen get a great deal of information and new thoughts from articles of this type.

We liked the photomicrograph on the cover but think that a detailed explanation should have been included. Not many foundrymen know what sand grains look like when magnified.

S. A. WICK
Technical Engineer
New Jersey Silica Sand Co.
Millville, N. J.

Editor's Note: Possibly some readers overlooked our explanation—on Page 3—that the October cover photo showed grains of Portage core sand. We also mentioned that the picture was taken at 60 magnification.

ANOTHER NORTON PRODUCT



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For More Information Circle 611, Page 39

Next Page Circle 612→

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WHEREVER METALS ARE CAST... FOUNDRY
NOVEMBER 1961

You Can't Beat Castings!

We grow a little weary of the inquiries from economists and business writers about the decline in foundry population. Foundry after foundry is going out of business, they point out—so isn't the industry dying?

If closed plants are a criterion of whether an industry is living or dying, the automotive industry should have been interred long ago. No other industry has had the mortality it has experienced, yet ended up with the ranking that motor car producers enjoy in industry today.

Fifty years ago more than 5000 foundries produced gray iron castings alone. Today not many more foundries than that produce all types of castings, but their combined capacity is many times what it was in 1911.

There is good reason for these changes in both the automotive and foundry industries. Cars are relatively cheap because they are mass-produced, and castings are made more economically on a high-production basis than by the way they were turned out a half-century ago.

There has been in the past—and will be in the future—a need for the small foundry capable of handling small, specialized jobs. This condition also exists in other industries. But we can expect a further decline in number of foundries which are neither adapted to the specialty type of business nor capable of competing for larger tonnage items. Their deficiencies are the result of one or more of various circumstances. Among the most important are the following:

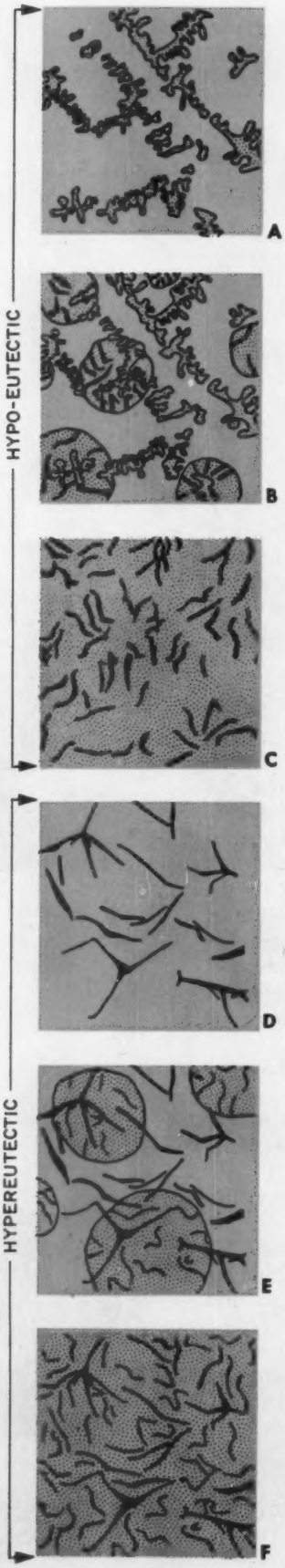
- Excessive costs through neglect of plant modernization and operating practice.
- Management obsolescence. Top officials ready to retire shortly aren't inclined to make the changes necessary to keep their companies competitive.
- Paying attention to product quality, but forgetting about selling what they're making. Maybe somebody will want to buy it.

The hundreds of automobile builders of recent decades have dwindled to the few left today. Similarly, many steel mills in existence during the last 50 years have been consolidated into a relatively few, highly efficient units.

Foundries are under the same economic pressure. Which ones will be left is up to the individual foundry. But you can't squelch an industry having a product that can't be made as well by any other fabricating method.

William G. Gude

Editor



SOLIDIFICATION, STRUCTURE, AND PROPERTIES OF . .

GRAY IRON

Variations in solidification of gray iron may be expressed in terms of nucleation and growth, the author explains. Mechanical properties can be dealt with in terms of structure when simultaneous changes in composition, graphitic pattern, eutectic cell distribution, and the type of matrix are taken into account

By HARISH D. MERCHANT
Research Metallurgist
Owens-Illinois Technical Center
Toledo, Ohio

Fig. 1—Schematic illustration shows sequence of solidification of hypo- and hypereutectic gray irons. A hypoeutectic gray iron solidifies in the following steps: A. Austenite dendrites form in the liquid. B. Eutectic cells of austenite and graphite grow along with the austenite dendrites. C. The result is graphite flakes in an austenite matrix. A hypereutectic gray iron follows a different sequence: D. Kish graphite forms first in the liquid. E. Eutectic cells of austenite and graphite form among the flakes of kish graphite. F. Again, the result is graphite flakes in an austenite matrix

● THE GRAPHITE in gray iron always is present as soft and friable flakes which interrupt the continuity of the comparatively hard matrix. These flakes do not have a typical pattern but may occur in a wide variety of sizes, shapes, and distribution. They may be straight (kish graphite), curved (Types A and D), or radially arranged (Type B). In general, they are distorted randomly and may be spatially arranged in complex shapes and groupings.

The physical and mechanical properties of gray iron are influenced by the size, shape, distribution, and amount of the graphite flakes. These variations in the pattern of graphite flakes result during solidification so that when considering the properties of gray iron, it is necessary to keep in mind the solidification mechanisms which impart the structure on the material.

Solidification Sequence—The sequence of solidification in hypo- and hypereutectic gray irons is illustrated schematically in Fig. 1. The first solidification in hypoeutectic iron (less than 4.30 per cent carbon equivalent) is in the form of primary austenite, almost always in a dendritic form (Fig. 1A). Solidification of these dendrites proceeds over a range of temperatures, and as the temperature is lowered, the remaining liquid is enriched in dissolved carbon. Eventually, the temperature reaches the upper limit of the eutectic range and the remaining liquid attains the eutectic composition.[1]

The first solidification in hypereutectic irons (more than 4.3 per cent carbon equivalent), on the other hand, is in the form of primary or kish graphite flakes which are large and straight and which often tend to float to the upper parts of the melt and create discrete chemical segregations in the casting (Fig. 1D). These flakes solidify over a range of temperatures, and as the temperature is lowered, the remaining liquid is depleted in dissolved carbon. As in hypoeutectic irons, when the temperature reaches the upper limit of the eutectic range the remaining liquid attains the eutectic composition.

Eutectic Cells—The final solidification in hypoeutectic or hypereutectic gray irons is in the form of eutectic cells, which are the aggregates of austenite and graphite. Eutectic cells solidify with more or less a spheroidal front over a narrow range of temperatures until all the melt is consumed (Fig. 1B and 1E). The graphite flakes precipitate directly from the melt[2] and grow more or less radially within a eutectic cell.

As each flake grows, it forms about itself a layer of solid austenite, and its lengthwise growth takes place with one of its ends at the periphery of the growing eutectic cell in contact with the liquid melt. Any carbon added to the sides of the flake, however, must diffuse through the layer of austenite surrounding it. Such preferred development of the graphite flakes, along with their natural crystalline habit,[3] gives them their characteristic shape.

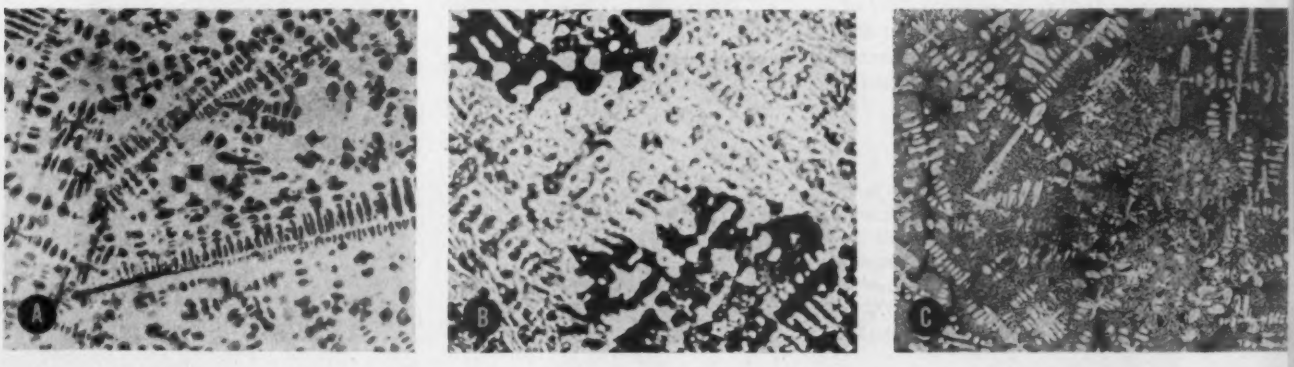
On completion of solidification, the primary austenite dendrites in hypoeutectic gray iron give an appearance to be continuous with the secondary austenite in the eutectic (Fig. 1C). In hypereutectic iron, however, primary graphite, which is the proeutectic phase, remains distinct from the graphite in the eutectic (Fig. 1F). Once the eutectic solidification is completed, the boundaries of the eutectic cells and the flake structure within them are established and do not change during subsequent cooling to room temperature.

Fig. 2 illustrates this sequence of solidification in an actual hypoeutectic gray iron quenched during various stages of solidification. The liquid melt after the severe quench appears as a very fine constituent which easily is distinguishable from the constituent which already has solidified. Fig. 2A[4] shows long, uniformly distributed and crowded primary dendrites in the melt quenched halfway during primary solidification. Fig. 2B shows the melt quenched during eutectic solidification where two eutectic cells are growing in the melt between the primary dendrites. Fig. 2C[4] shows the eutectic cell structure of a completely solidified melt.

This simple sequence of solidification takes place by a process of successive nucleation of widely differing solid constituents in liquid metal and subsequent growth of these constituents into the melt. Both nucleation and growth are influenced greatly by a number of factors and by each other. Any changes in nucleation and growth are capable of producing significant changes in the solidification process with subsequent variations in type and form of the graphite constituent.

At the Start—In liquid metal there exist a number of variously sized particles or certain undefined

Fig. 2—A. Primary dendrites have formed during proeutectic solidification of a hypoeutectic gray iron (heat tinted, X20). B. Two secondary cells have formed during eutectic solidification (4% Picral etch, X50). C. Dendritic and eutectic structures in the solid casting (heat tinted, X20). (A and C after Boyles[4])



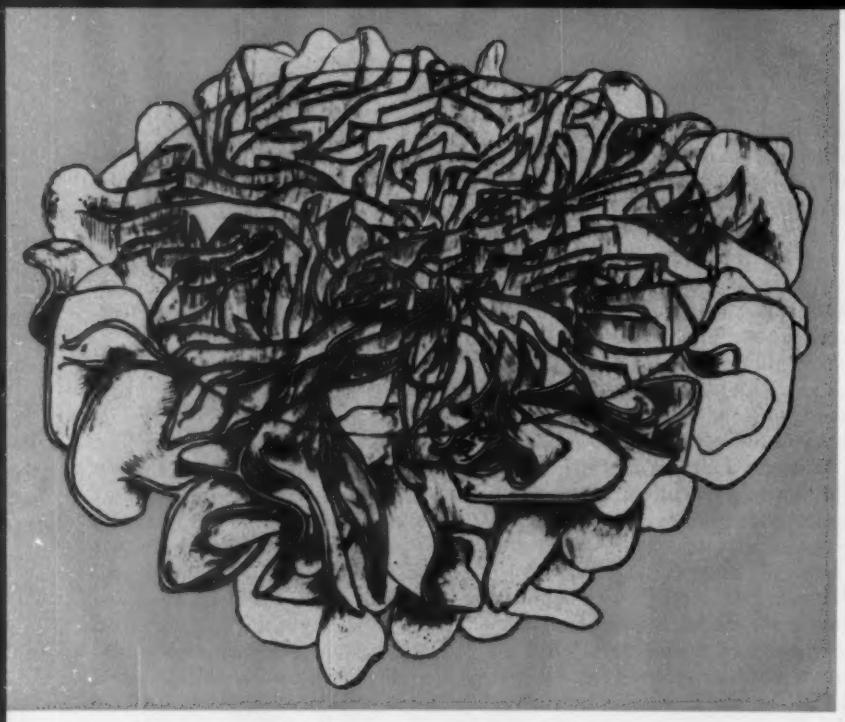


Fig. 3—Model represents a typical graphite skeleton found in a eutectic cell[7, 15, 18]

localized physical and chemical conditions from which the solidification initiates. This nucleation or initiation of solidification usually is preceded by some undercooling of the liquid melt below the theoretical melting temperature. The liquid may continue to undercool, however, even after the initiation of solidification. This is explained in the following manner:

If N nuclei, each having the surface area A, are growing at a radial growth rate dR/dt at a given instant, the rate at which heat is liberated due to the growth of these nuclei is given by $dR/dt \times N \times A \times L$, where L is the latent heat of fusion per unit volume. If dQ/dt is the rate of heat extraction, the melt will continue to undercool until,

$$dR/dt \times N \times A \times L = dQ/dt$$

From this equation it is obvious that undercooling will increase if a) radial growth decreases, b) number of nuclei growing decreases, or c) the rate of heat extraction increases. It also has been demonstrated theoretically that an increase in undercooling subsequently will increase the nucleation and growth rates.[5,6]

If for the sake of simplicity, only the eutectic solidification in gray iron is considered, the quantitative assessment of the number of nuclei growing is very easily done by actually counting the eutectic cells in a given section. A direct measure of radial growth rate, however, is difficult, but an indirect qualitative estimate of it is possible if the internal structure of a eutectic cell of gray iron is understood.

For many years it was believed that all graphite flakes in gray iron eutectic were dispersed so that they were separated from one another by metal. More recently, however, some Russian and British workers[7,8] have shown that the graphite flakes within a eutectic cell are interconnected in a continuous skeleton of graphite and represent a more or less frequently branched crystallization. Each cell thus represents a unit of solidification so that the nucleation process does not concern each individual graphite flake, but much less numerous eutectic cells. A model of the graphite skeleton representing a eutectic cell is illustrated in Fig. 3.

Implications—This branching of eutectic graphite during solidification has several interesting implications: a) linear growth rate of graphite may be limited and in order to keep pace with growing austenite phase, it has to branch in a manner such that the faster the growth rate of the cell, the more frequent is the branching; b) branching may be an easier process of growth than fresh nucleation of graphite flakes elsewhere; c) diffusion near a growing lamella may

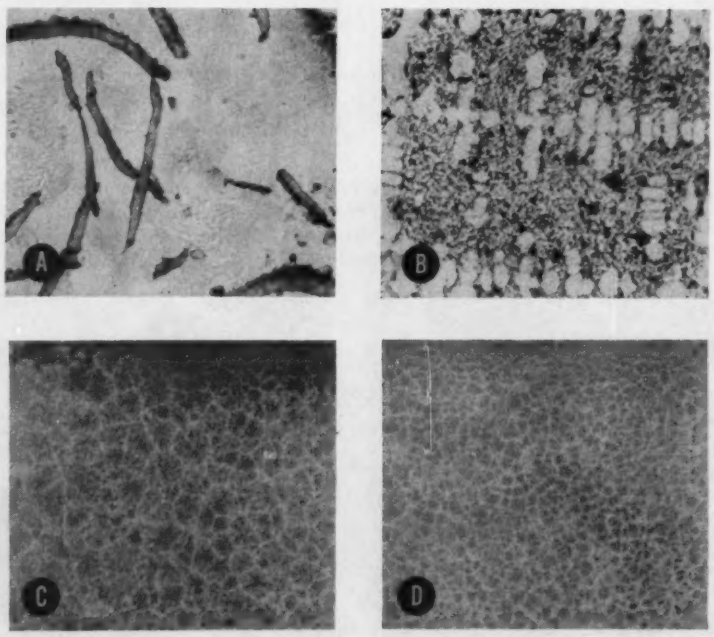


Fig. 4—Effects of rate of heat extraction on graphitic (A and B) and eutectic structures (C and D). A and C were cast in a sand mold; B and D in a metal mold. A and B were etched with 4% Picral, X25; C and D with Marble's reagent, X3

take place in a manner such that the regions of supersaturation exist for branching to occur.

Thus it seems reasonable to assume that finely distributed, small and thin graphite flakes may indicate a fast radial growth rate of the eutectic cells and fewer, long and thick graphite flakes may inindicate slow radial growth of the eutectic cells.

From the arguments presented in the last few paragraphs, it is obvious that cooling rate, growth rate, and nucleation are three important variables which tend to influence the solidification behavior of gray iron. An attempt to control or manipulate one automatically results in changes in the other two. For example, increasing the cooling rate will increase the undercooling which, in turn, increases the number of nuclei growing and their growth rate. The increased nucleation results in more numerous eutectic cells, and the increased growth rate results in more frequent branching of graphite within the eutectic cells, thus exhibiting numerous fine graphite flakes on a microsection.

Similarly, increasing the nucleation of the melt will increase the eutectic cell count, at the same time reducing undercooling which results in slower growth rate of the eutectic cells, less frequent branching of graphite and coarser graphite flakes. Finally, reducing the growth rate of eutectic cells will give coarser graphite flakes and at the same time will increase the undercooling which results in increased number of nuclei growing and higher eutectic cell count.

Variations Feasible—In practice, such controlled variations in either cooling rate, nucleation, or growth rate are feasible and are duly illustrated in the literature. For example, increased cooling rate obtained by decreasing the pouring temperature,[9] by decreasing the section size[10] or by approaching towards the periphery of the casting[11] results in increased undercooling,[2] higher eutectic cell count, and finer graphite flakes.

The effects of rate of heat extraction on eutectic cell structure and the graphitic pattern are illustrated in Fig. 4 in two castings, one made in a green sand mold and the other in a metal mold. It is seen that faster rate of cooling in the metal mold gives fine eutectic cells and very fine Type D graphite structure.

Increased nucleation of the melt is obtained by ladle additions of ferrosilicon, calcium silicide, graphite, or carbon and silicon, or phosphorus.[11,13] Such additions would reduce undercooling, increase the cell count and result in coarser graphite.[2,11] Addition of ferrosilicon has been shown to reduce the radial growth rate of eutectic cells.[11]

Decrease in the nucleation of the melt is obtained by holding the melt at high temperature, superheating, or agitation.[14,15] It gives exactly opposite results to those obtained by increasing the nucleation of the melt, such as coarse eutectic cells, increased undercooling, and fine graphite flakes.

The effects of increased nucleation of the melt on eutectic cell structure and graphitic pattern are illustrated in Fig. 5 in two castings made with and without the additions of ferrosilicon. It is observed that ferrosilicon addition gives finer eutectic cells and coarse Type A graphite structure.

Composition Effect — Direct influence on growth rate of eutectic cells is known to be brought about only by small composition changes. For example, sulfur reduces the growth rate of eutectic cells.[16] Actual growth rate measurements or calculations in this instance have not been made, but the effect of growth inhibition due to sulfur has been deduced from the circumstantial evidences like its effects on nucleation, undercooling, and graphite structure.

Sulfur increases undercooling and eutectic cell count and gives coarse Type A graphite. Titanium, zirconium, and manganese tend to remove sulfur from the melt and reduce its effects.[16,17] Effects of sulfur and titanium on graphite structure are shown in Fig. 6. It is observed that addition of sulfur tends to coarsen graphite structure. Titanium removes sulfur from the melt and refines the graphitic pattern.

Tellurium and selenium have been shown to affect the solidification of gray iron in a manner similar to that of sulfur.[16] Hydrogen also seems to affect the growth rate like sulfur. It increases the undercooling and coarsens graphite, but does not seem to change the eutectic cell count[16,18] appreciably.

Chilling Tendency—Tendency of gray iron towards chilling also can be explained by the mechanisms of nucleation and growth. It is known that for most compositions of gray

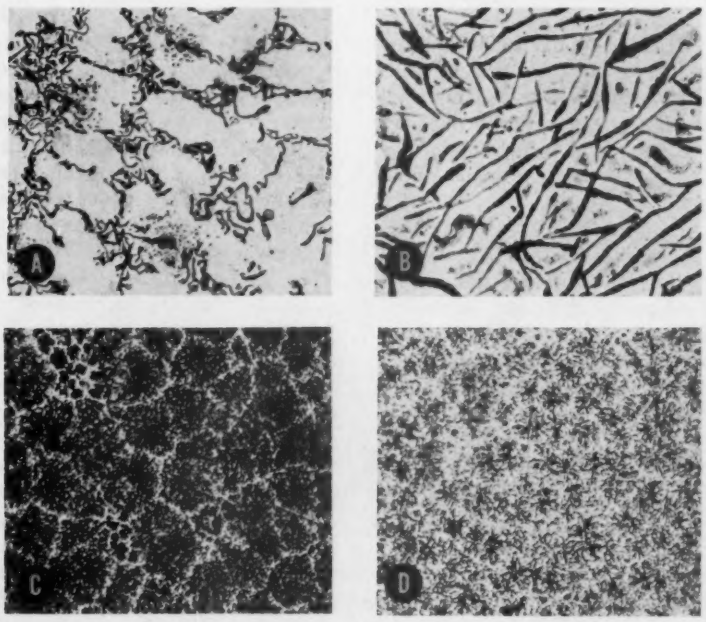


Fig. 5—Effects of ferrosilicon additions on graphitic (A and B) and eutectic structures (C and D). A and C had no addition; B and D had a .63% addition. A and B were etched with 4% Picral, X100; C and D with Marble's reagent, X9

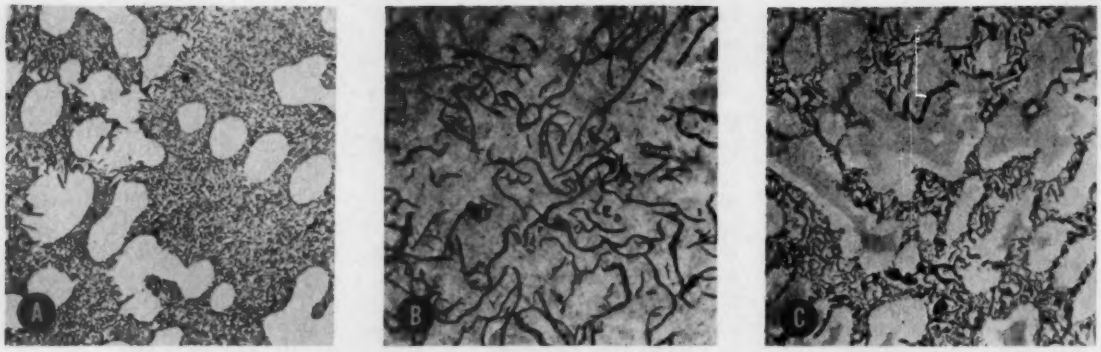


Fig. 6—A. Micrograph shows effect on graphite of adding .002 per cent sulfur. B. Effect of adding .072 per cent sulfur. C. Effect of adding .20 per cent titanium. All specimens were etched with 4 per cent Picral, X100 (after Oldfield[16])

iron, the *carbide-austenite* eutectic solidifies at a lower temperature than the graphite-austenite eutectic. Thus, for a given gray iron composition, to avoid solidifying as carbide-austenite eutectic one must reduce the undercooling of the alloy as far as possible.

This may be done by reducing the cooling rate, or increasing the nucleation of the melt or the growth rate of the eutectic cells. The effect of an increase in section size (i.e., decrease in cooling rate) on the reduction in chilling tendency is well known. The effect of increased nucleation is confirmed easily in practice by additions such as ferrosilicon, phosphorus, graphite, etc., which increase the nucleation of the melt and at the same time reduce chilling and mottling tendencies.[19,20]

Recently it has been shown that the nucleation of the melt also may be increased by induced vibrations. Vibrating the melt during solidification seems to increase the eutectic cell count, coarsen graphite, and reduce the chilling tendency.[21,22] It must be emphasized that any treatment of the melt which may change its nucleation or freezing rate also may alter its chilling behavior. For example, high furnace temperature or holding the melt for some time at high temperature reduces the nucleation of the melt and consequently increases its chilling and mottling tendencies.[20,23] Also, high pouring temperatures accompanied by slow freezing rates reduce the undercooling; hence the chilling tendency of iron is reduced.[20,24]

Increase Nucleation — Some growth inhibiting additions, however, in addition to reducing growth rate of eutectic cells, also tend to increase simultaneously the nucleation of the melt. When added in very small amounts, the effect on nucleation of the melt is predominant so that undercooling of the alloy decreases, thus encouraging reduction in chill. When these additions are made in comparatively larger quantities, however, the effect on the growth rate becomes predominant so that undercooling of the alloy increases, thus promoting chill.

These opposing effects are well illustrated by the additions of sulfur, selenium, and tellurium.[16,18] They act as carbide stabilizers in large quantities but reverse their behavior when added in smaller amounts. The effect of sulfur on graphite flake size and carbide formation is shown in Fig. 7. It is observed that sulfur tends to coarsen graphite size up to about 0.1 per cent sulfur. When added in quantities of more than 0.2 per cent, however, it tends to form carbide-austenite eutectic in increasing proportions. Between 0.1 and 0.2 per cent sulfur, anomalous graphite structure appears as mesh graphite.

The foregoing discussion covers the principles of solidification of gray iron whereby it is shown that the difference between theoretical and non-equilibrium eutectic arrest temperatures, i.e. the undercooling, plays an all-important part in conferring the structure on the material. Desired structures may be obtained by proper manipulation of cooling, nucleation, and growth conditions of the melt.

Effect on Properties—Insufficient data are available to make a precise correlation between the structure variations and properties of gray iron. It may be safely stated, however, that the mechanical properties of gray iron depend mainly on the amount, size, and shape of the graphite flakes, the size and distribution of the eutectic cells, and the type of matrix. Consequently, by modifying the graphite flakes, eutectic cells, and the matrix simultaneously or individually, it is possible to improve particularly tensile strength and shock resistance which are characteristically poor in gray iron.

An individual graphite flake in gray iron is superficially a curved basal section so that the closed packed planes are oriented along the length of each flake.[3] The graphite flakes have very little cohesive strength in their own right because the layered hexagonal closely packed structure permits easy slip along the basal planes. Consequently, an increase in graphitic carbon reduces the effective metallic cross section of the casting, thus reducing its strength. In addition, peculiarly sharp edges of the graphite flakes probably are the points of weakness and are surrounded by an area of high stress concentration. This may often render the irons containing numerous fine flakes inferior to those containing coarse flakes.

An individual eutectic cell essentially is an aggregate of two interwoven structures of graphite and austenite. The graphite in the cell is in the form of a continuous skeleton, and the austenite envelops this graphite skeleton. Because the flakes in a eutectic cell are interconnected, each graphite skeleton represents a plane of weakness, and

decreasing the size of the cells makes these planes of weakness smaller and may improve the strength of the alloy.

As the eutectic cells solidify, they segregate impurities at the advancing solid-liquid interface. When the cells impinge upon one another at the completion of the eutectic solidification, some impurities like sulfur and phosphorus still remain in the cell boundaries. This preferred distribution of impurities in the cell boundaries may decrease the mechanical properties, particularly impact strength and ductility of the material. Smaller, more numerous eutectic cells have lower density of impurities in the cell boundaries for a given per cent of phosphorus and sulfur, so that decreasing the size of the cells may improve the strength and ductility of gray iron.

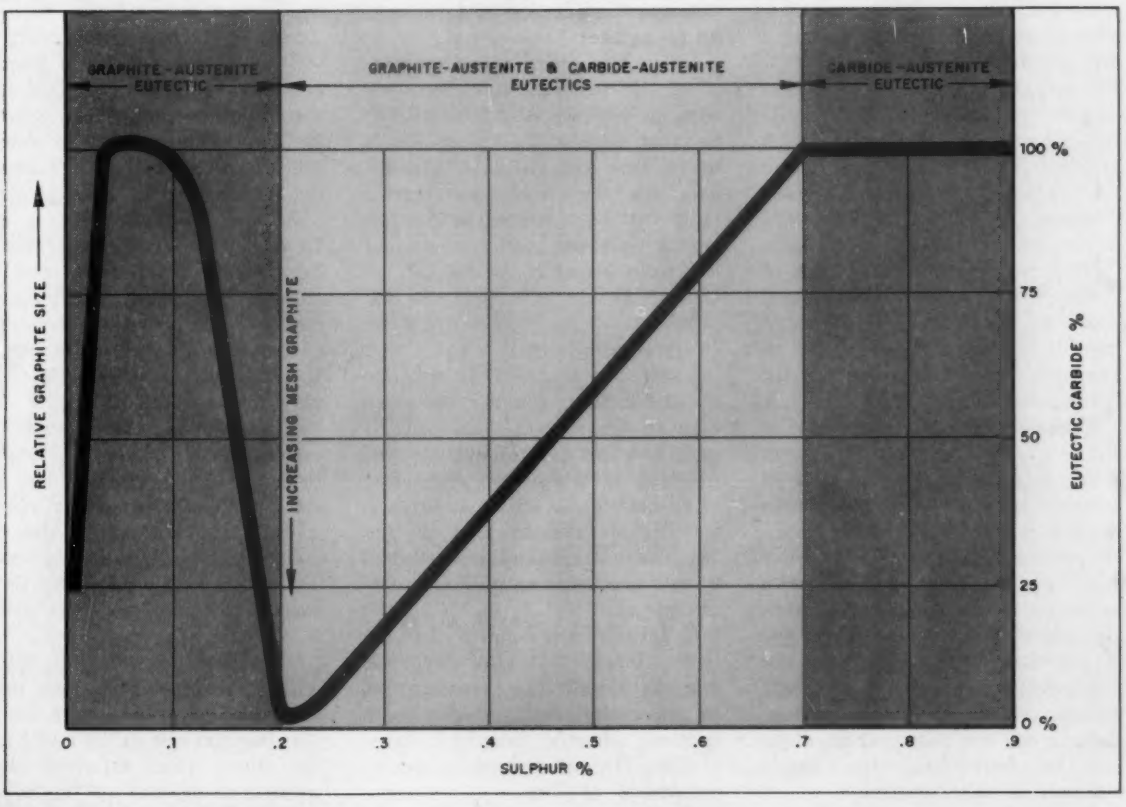
Gray Iron Matrix — The matrix in plain gray iron may be ferritic, pearlitic, or both, with various amounts of dissolved phosphorus, silicon, manganese, and sulfur, and some carbon present in the matrix as layers of iron carbide in pearlite. The presence of ferrite in the matrix of an as-cast structure depends on stability of pearlite and to a certain extent on size and shape of graphite. If the pearlite is not very stable, iron carbide in it decomposes during cooling of the casting, and the carbon from the decomposed carbide diffuses to the nearest graphite flakes.

It seems that the tendency of pearlite to decompose depends somewhat on the diffusion distance to the graphite flakes and the surface area of the flakes open for carbon deposition. The longer distance in the matrix between flakes in Type A graphite, in addition to their smaller surface area, seems to favor a pearlitic matrix in gray irons containing coarse Type A graphite flakes; on the other hand, the shorter distance between the thinner Type D graphite flakes, along with their larger surface area, tends to produce a ferritic matrix.

The pearlite in gray iron is harder and stronger than ferrite. Also, the finer the alternate plates of carbide and ferrite in the pearlite, the higher its hardness and strength. Ferrite, on the other hand, is softer and more ductile. Its strength depends to a certain extent upon the quantities of dissolved silicon, manganese, phosphorus, and sulfur. The type of matrix is a fair measure of hardness, wear resistance, and machinability. The pearlite gives gray iron high strength and wear resistance, whereas ferrite improves its ductility and machinability.

Graphitic Carbon Effect — Relative contributions of the graphite flakes, eutectic cells, and the type of matrix to the mechanical behavior of gray iron are difficult to establish. The amount of graphitic carbon seems to have an overwhelming effect, and very often it tends to dominate the picture when gray irons of different carbon equivalent are compared. Attempts have been made to relate the mechanical properties to the graphitic pattern and the matrix without paying much attention to the eutectic cell structure. The degree of correlation in such instances has not always been very high. This is particularly

Fig. 7—Graph shows effect of sulfur additions on graphite size and carbide stabilization in Fe-C-Si alloy (after Garber[18])



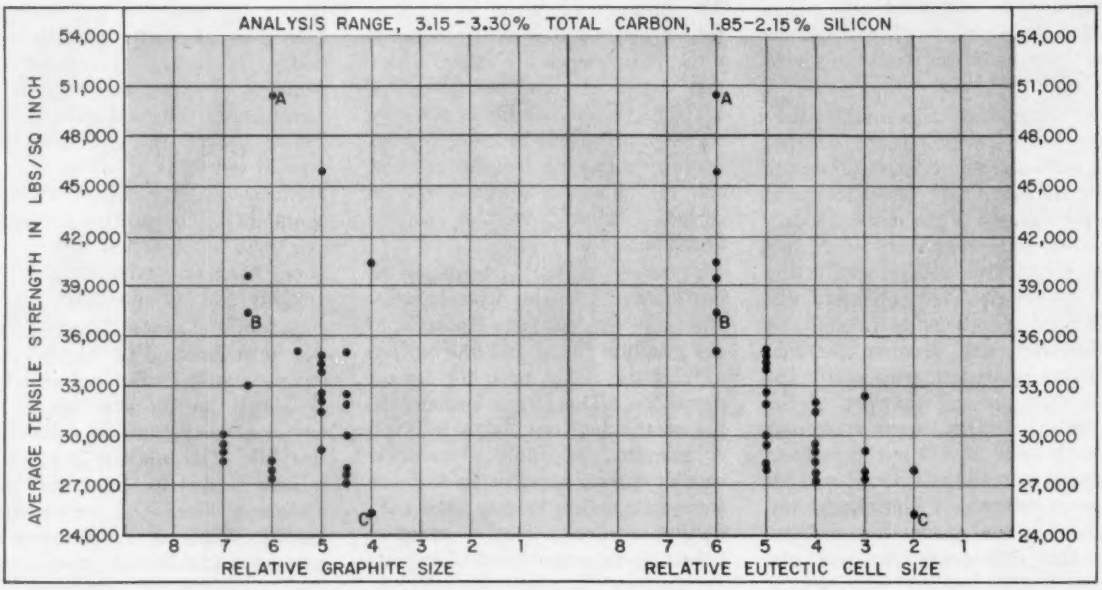


Fig. 8—Chart presents data showing influence of graphite size and eutectic cell size on tensile strength of gray iron (after Adams[26])

true when simultaneous changes take place in graphitic pattern, cell structure, and the matrix.

The effect of structure on tensile strength is illustrated here. A cursory examination of the literature reveals that an inconsistent relationship exists between tensile strength and graphitic structure. High tensile strength of gray iron of a given composition calls for: a) fine eutectic cell structure, b) coarse Type A graphite, and c) fine pearlitic matrix. If two of these factors are held constant, an increase in the third invariably will increase strength. This is borne out in the work of Adams,[26] who correlated tensile and transvere strengths of a number of pearlitic irons with the sizes of graphite flakes and eutectic cells. Some of his data are plotted in Fig. 8.

Wider Scatter—It is observed that the plot of graphite flake size shows much wider scatter than that of eutectic cell size. Also, the irons marked A and B have a fine graphite structure but they exhibit fairly high strength because they have a very fine eutectic cell size. Also, the iron marked C has coarse Type A graphite but it exhibits very low strength because it has very large eutectic cell size. The dominance of eutectic cell size over graphite flake size in determining the tensile strength is quite obvious.

When eutectic cell size and graphite size are considered simultaneously for the data plotted in Fig. 8, the following relationship is obtained:

Tensile Strength = 25,701 − 3229 (Eutectic Cell Size) + 1444 (Graphite Flake Size)

Using this equation, an estimate of tensile strength may be made with an accuracy of ±3000 psi. If, however, carbon equivalent also is taken into consideration, Adams' data for the whole composition range can be expressed by the following equation:

Tensile Strength = 140,106 − 1897 (Eutectic Cell Size) + 886 (Graphite Flake Size) − 28,181 (Carbon Equivalent)

Using this equation, an estimate of tensile strength may be made with an accuracy of ±2500 psi. It must be noted that the average contribution of the carbon equivalent in decreasing the tensile strength is very high, whereas that of the graphite flakes is the lowest. Eutectic cell size seems to play an intermediate role.

Ordinarily it is believed that the fewer, longer flakes of Type A graphite usually are accompanied by fine eutectic cells, whereas more frequent, shorter, branched flakes of Type D graphite usually are accompanied by large eutectic cells. This again is exemplified in the work of Adams as shown in Fig. 9.

Although a tendency of Type D graphite to appear with larger eutectic cells and Type A graphite to appear with smaller eutectic cells is observed in this figure, the scatter is very high so that for a given cell size a large variety of graphite sizes may be obtained. This large scatter does not permit neglecting the graphite flake size or eutectic cell size as a variable in determining the tensile strength of gray iron.

Relationship Factors—As a matter of fact, the relationship between the graphite flake size and the eutectic cell size depends on cooling, nucleation, and growth conditions of the melt. An extreme comparison is presented in the case of two gray irons shown in Fig. 4. The iron cast in the metal mold has extremely fine Type D graphite flakes and, at the same time, it is accompanied by very fine eutectic cells. The iron cast in the sand mold, on the other hand, has coarse Type A graphite flakes and is accompanied by comparatively large eutectic cells.

The predominance of eutectic cell size in determining the tensile strength again is evident in the fact that the iron cast in the metal mold has almost twice as much tensile strength as the one cast in the sand

mold, and the strength reducing effect of fine graphite flakes is more than compensated for by the strength enhancing effect of very fine eutectic cells.

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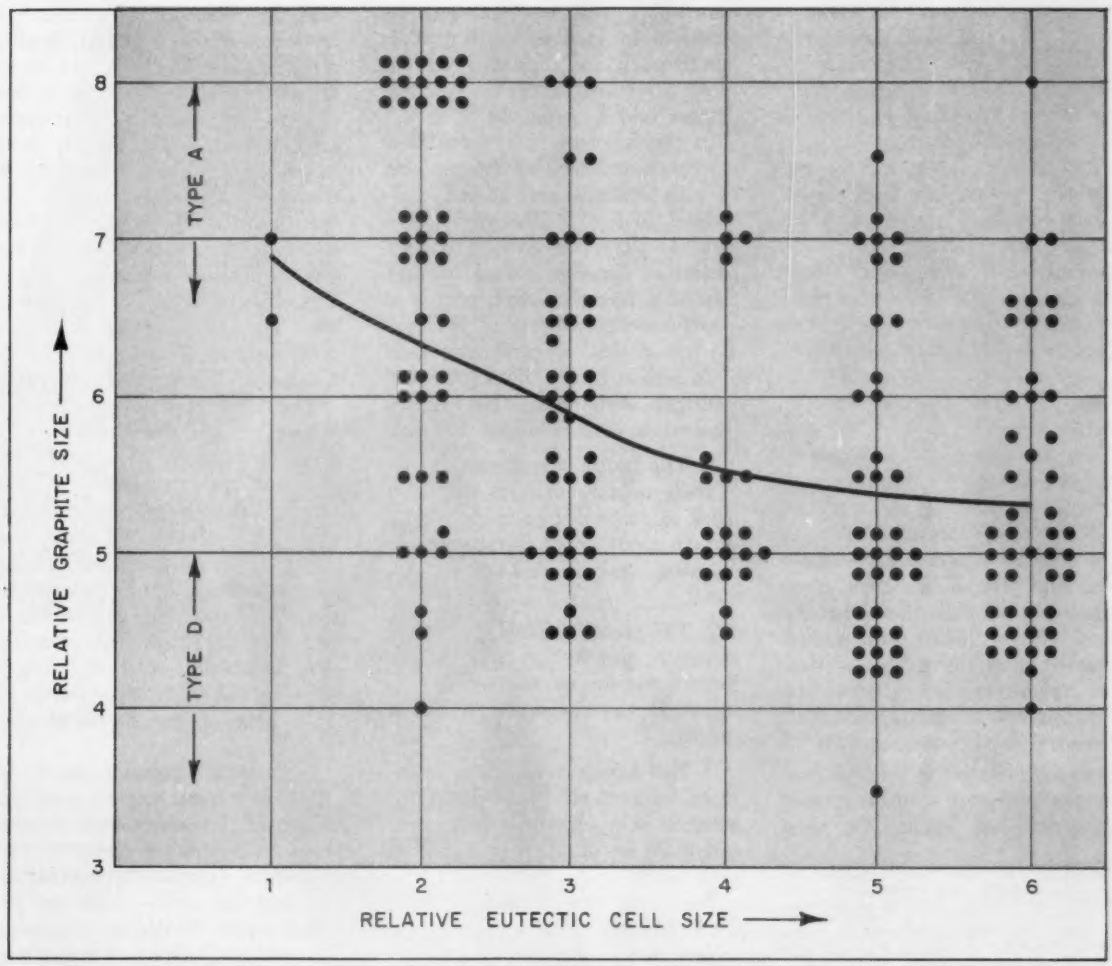
Fig. 9—Relationship between graphite size and eutectic cell size. Type D graphite tends to appear with larger eutectic cells, Type A with smaller eutectic cells



Develops New

Shell Molding Process

Here are details on a new process for producing low-carbon and low-alloy steel castings in shell molds. Cost considerations also are covered

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● SEARCH for a complete solution to the problems of casting low-carbon and low-alloy steels in shell molds led ultimately to development of the Chilmet Process. It is the result of combining new developments in shell molding materials with a special method for making shell molds.

The molding compositions are based on findings previously reported by the authors wherein granular limestone was used in shell molds for producing low-carbon and low-alloy steel castings free of surface blemishes[1]. Composite, or laminated, shell molds are made by double investment, a technique described in patents assigned to the Ford Motor Co.[2]

To make the process available to industry, automatic machines are being designed* to produce shell molds by double investment at competitive and practical production rates. The process has been given preliminary pilot plant testing and is now being evaluated using a semi-automatic machine capable of handling commercial size patterns. The method offers possibilities for casting steel and other metals.

Steel founders are well acquainted with the problems of making steel casting in shell molds. The first reference to these problems is found in an article by Ames, Donner, and Kahn[3]. They noted "sound medium-carbon steel castings may be produced in shell molds, but additional work on improving surface finish is required before extreme tolerances may be obtained."

In the following years, considerable work was done on this problem here in America and abroad, References 4, 6, 7, 8, 9, 10, and 11. On Aug. 1, 1953, the Steel Founders' Society of America started sponsorship of a 1-year research project at Massachusetts Institute of Technology on means of producing good plain-carbon and low-alloy steel castings in shell molds. That research resulted in the following findings:

1. The use of manganese dioxide in shell molding mixtures was beneficial to some degree in improving surface condition of castings and in reducing carbon pick-up by the metal.

2. The use of chilling sands, such as zircon, chrome ore, and particularly forsterite or olivine, further improved the surface condition of castings.

3. The defects appeared to be due to an unfavorable time relationship between skin formation of castings and build up of gas pressure in the shell molds.

Results of the research at MIT for SFSA were made known by the society to its members in Research Report No. 34. That report also included some results of a second research project being sponsored at MIT by Watertown Arsenal. The latter research showed that the effect of manganese dioxide could be enhanced by the use of a small amount of lead dioxide; also, carbonates, such as Na_2CO_3 and $CaCO_3$, added to shell molding mixtures in an amount of about 50 per cent of the resin content by weight, produced an improvement in the surface conditions of steel castings similar to that obtained with manganese dioxide. The results of this work were published in *Transactions* of the American Foundrymen's Society.[5]

The Chilmet Process—This new process consists essentially in using a substantial amount of a granular carbonate, such as calcium or magnesium carbonate, mixed with silica sand and resin for making shell molds which possess desirable chilling properties and improved thermal shock resistance. The shell molds are of composite (laminated) construction, combining a thin facing of resin-bonded refractory materals and a backing of the carbonate-silica mixture.

Granulated limestone or marble chips are suitable sources of calcium carbonate, but granulated dolomite (calcium-magnesium carbonate) and magnesite (magnesium carbonate) also may be used. Molds are produced readily by double investment.

A precoated refractory is preferred

*Petrocarb Inc., New York, subsidiary of Cabot Corp., Boston, has acquired all rights to the Chilmet Process, including an exclusive license under Ford Motor Co. double investment patents, and will be ready to issue non-exclusive rights for its use at the conclusion of the current test program.

for Steel

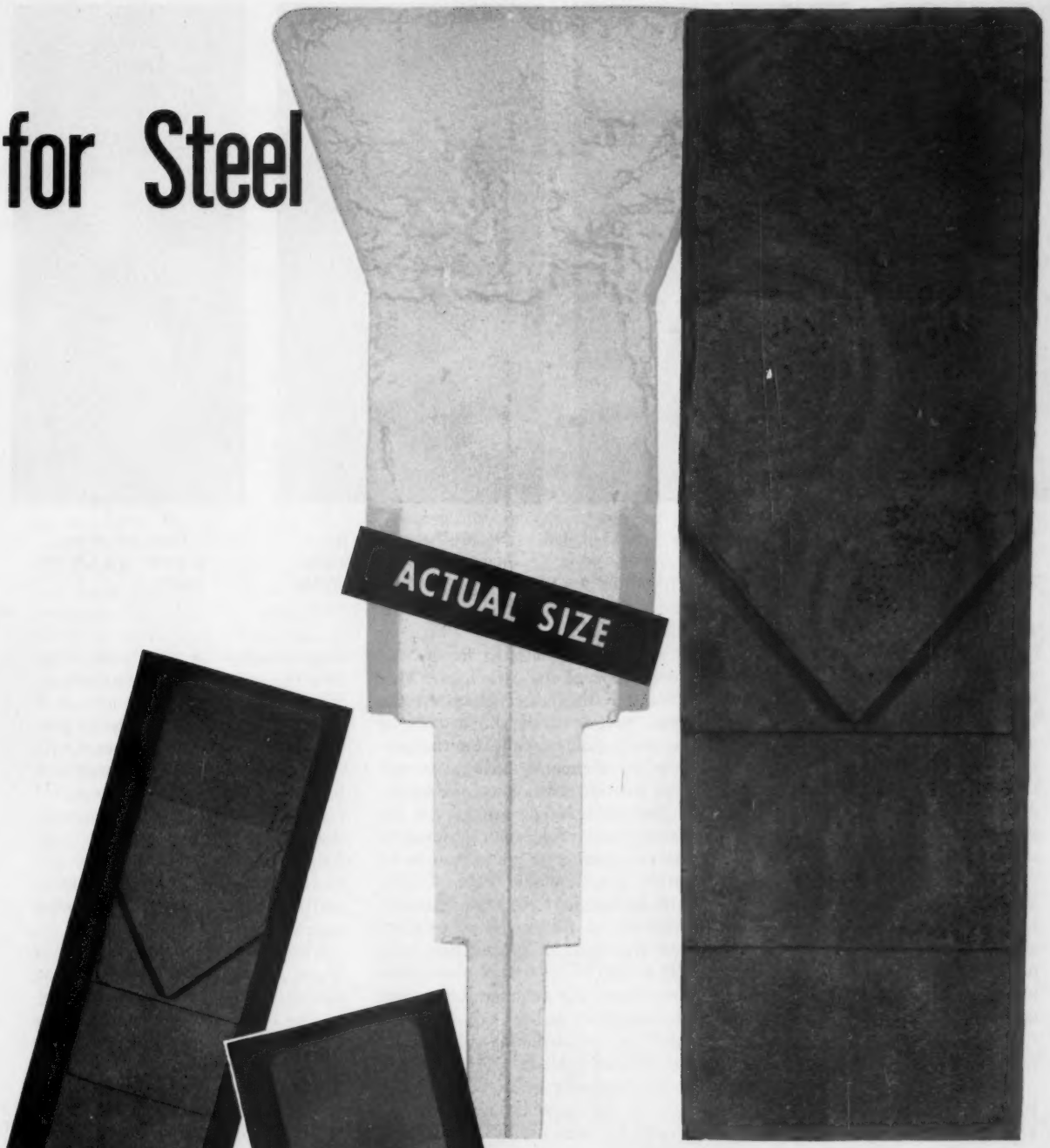

Fig. 1—Casting above is low-carbon steel cast in a silica sand shell mold. Side view, above left, shows sections ½ to 2 in. thick, varying in ½-in. increments

Fig. 2—Experimental step casting of low-carbon steel was made in a shell mold of zircon sand

Fig. 3—Experimental step casting of low-carbon steel made in a shell mold of zircon sand containing MnO_2

Fig. 4—This low-carbon steel casting was made in a Chilmet shell mold

Fig. 5—Gate is for 3-in. steel valve. It was cast in a silica sand shell mold

Fig. 6—This gate is for same valve cast in a shell mold of zircon with MnO_2

Fig. 7—Gate for valve casting made in a Chilmet shell mold

for the facing layer of the mold because it provides for uniform distribution of the resin binder at the face of the mold where segregation of the organic binder can not be tolerated. A fine sand with addition of iron oxide or manganese dioxide, and sometimes silica flour, is used to produce castings with smooth surfaces.

The sand and limestone, or sand and dolomite used for the back-up layer can be relatively coarse since they do not contact the metal poured. Dry resin also can be used in the backing mixture without detrimental effect on castings, and this actually provides optimum adhesion between the mold layers.

The amount of granular carbonate which must be included in a molding composition depends upon the effect sought. From 5 to 8 per cent normally is sufficient when only improved thermal shock resistance of the molds is desired. Twenty per cent or more, however, may be used to provide an effective chilling action.

Chilling Action Explained—The chilling action of the molds is the result of an endothermic dissociation of the carbonates, plus the further endothermic reaction of the carbon dioxide resulting from such dissociation with the carbon of the resin binder. In addition, the expansion of silica is compensated for by decomposition of the carbonates. This effect and the protection given the resin binder in the outer part of the shell molds by the internal absorption of heat contribute to the high thermal resistance of the molds.

The changes of enthalpy in the dissociations of limestone, dolomite and magnesite in the presence of carbon are shown in Table I. It is well known that the dissociation of limestone in air actively takes place over the range of temperature from 800 to 900° C.[12,13] At this temperature level, the reaction of carbon dioxide with carbon can go practically to completion as indicated by the data in Table II.

The behavior of dolomite under heat is not as well known, but it clearly has been established that the dissociation of the compound occurs over the range of temperature from 650 to 900° C.[14] This also is a proper temperature for a major part of the carbon dioxide to react with carbon. In the case of magnesite, however, little carbon dioxide would react with carbon since the dissociation of this carbonate starts at about 350° C. and is virtually complete at 550° C.[15] This material is particularly useful for control of thermal expansion.

TABLE I—Dissociation of Limestone, Dolomite, and Magnesite in the Presence of Carbon

	Δ H° (cal/gram carbonate)
(1) $CaCO_3 + C \rightarrow CaO + 2CO$	+844
(2) $CaCO_3 \times MgCO_3 + C \rightarrow CaO + MgO + 4CO$	+855
(3) $MgCO_3 + C \rightarrow MgO + CO_2 + C$	+324

TABLE II—Equilibrium of Reaction $CO_2 + C \rightleftarrows 2CO$[16]

Temperature, ° C	% CO_2
500	95.0
600	77.0
700	68.0
800	7.0
1000	0.6

The thickness of the facing layer is an important factor controlling the chilling efficiency of the carbonate composition. Although the facing should be as thin as possible from the standpoint of chilling, it should not be so thin, particularly with steel, as to allow mold surface reactions involving lime. A thickness of about 1/16 in. has proved most convenient, although a facing layer half this thickness was used with remarkable success on small castings. This may be the lower practical limit, since investing a layer thinner than 1/32 in. would be difficult in practice.

On the other hand, the surface chilling effect of carbonates disappears when the facing is thicker than about 3/32 in. The thickness of the backing layer may be varied to fit the work being done. With a ¼-in. backing, the total mold

thickness would be about the same as that of average shell molds used currently in production. More backing can be used for making thicker and stronger molds if necessary.

Time Is Important—When making shell molds by double investment it is important that not too much time elapse between the first and the second investment to prevent delamination of the molds. Properly made composite shell molds have good mechanical properties and can be assembled by the usual technique of pasting and pressing mold halves together.

Swelling of large castings, which sometimes occurs when regular sand shell molds are used, and which often occurs in zircon molds containing an oxidizing additive, has not been observed in composite molds made with the carbonate composition. Advantages also result from the fact that no metal penetrates into the molds, and practically no refractory adheres to the castings. These troubles are prevented by the endothermic reactions of the mold backing composition which inhibit heating of the fine refractory facing to high temperatures.

Consequently, the castings require minimum cleaning and have exceptionally smooth surface finish. The good chilling property of the molds insures castings of optimum accuracy and tolerance; however, the chilling action is delayed just long enough to permit complete and full mold filling without laps and misruns, thus permitting the fine sand to yield smooth, sharp surface detail to the casting.

Even though olivine improves the surface condition of castings more than does zircon, the latter, in combination with metal oxides, generally has been preferred by the larger commercial foundries for producing steel castings in shell molds. The reason is that zircon offers the possibility of considerable savings in resin binder over an olivine operation, and because difficulties are experienced with olivine in obtaining sharpness of detail on low-carbon steel castings. To evaluate the merits of the Chilmet Process, casting results must be compared with those obtained with silica sand molds as well as with zircon molds containing additions of manganese dioxide.

Compare Casting Surface—The surface appearance of a series of experimental castings poured from the same heat of low-carbon steel is illustrated in Fig. 1, 2, 3, and 4. The step castings shown weigh 9 lb each and have section thicknesses of ½, 1, 1½ and 2 in. The metal was poured at 2900° F directly through the top of the mold.

In this and following experiments, the standard silica molds were made with a good grade of sand, 130 AFS fineness, precoated with 4 per cent resin. For the zircon molds, Australian zircon of 120 AFS fineness, precoated with 2 per cent resin, was used. When manganese dioxide was applied, 0.75 per cent by weight of the powder was added to the coated zircon.

Substantial improvement resulted from the use of zircon and further improvement was obtained when manganese dioxide was added to the material. The best surface, however, was produced in the composite shell mold. The facing of this mold was made with the same grade of silica sand as used for the standard mold, but 1.5 per cent iron oxide was added. The backing composition was a dry mixture of 65 per cent silica sand of 80 AFS fineness, 30 per cent granulated limestone, and 5 per cent resin. All molds were bedded in roofing gravel for pouring.

Another relatively large casting is shown in Fig. 5, 6, and 7. This is a gate casting for a 3-in. valve. With riser, as shown in Fig. 7, the weight is 13 lb. In the same manner as in the case of the step castings, low-carbon steel from one heat was poured at 2900° F directly through the top of the riser. Both the silica sand and zircon molds cracked and metal ran out of the riser. In addition to illustrating the superior thermal shock resistance of the carbonate molds, this experiment again shows the excellent surface finish obtained in that type of mold.

Other castings of industrial designs made in the composite shell molds are shown in Fig. 8 and 9 to further illustrate the good surface condition attainable. The body for a 3-in. gate valve is shown in Fig. 8. With risers and sprue, the casting weighs approximately 35 lb. It was made of low-carbon steel poured at 2875° F.

In Fig. 9, two castings, of a design originally attempted in investment molds, are shown to illustrate the sharpness of detail obtainable with the process. They were made of low-alloy, 4340 steel. Each casting required pouring about 70 lb of metal into the shell mold. The surfaces of the rather massive risers used on these castings were as smooth and sharp as the surfaces of the bodies of the castings.

Economic Considerations — The economics of the reclaimed zircon shell molding process have been studied by Jackson and Glick[6] who showed that this practice would not be more expensive than a corresponding silica sand practice if 95 per cent of the zircon could be reclaimed. A similar study is made here comparing the reclaimed zircon practice with the carbonate process. The cost of making molds

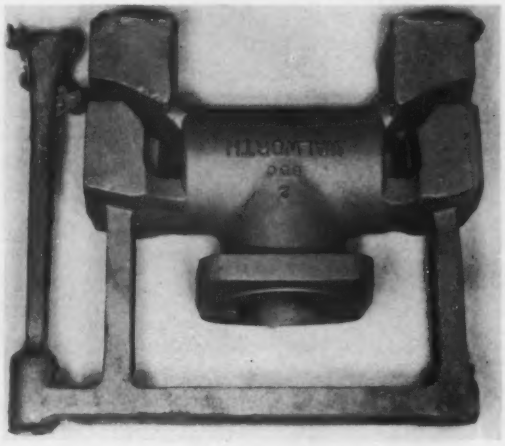

Fig. 8—Body of a 3-in. gate valve. The low-carbon steel casting was made in a Chilmet shell mold

which would be closely the same in both cases is not considered. Rather, the calculations are based on equivalent volumes of molding materials required to make the same number of molds.

It is first considered that, while the density of zircon (4.56) is 1.72 times that of silica (2.65), the bulk density of a zircon shell mold is twice that of a silica sand shell mold due to better packing of zircon. In addition, the bulk density of granular limestone is very closely the same as that of silica sand. Therefore, the study is based on a comparison of 2 tons of zircon with 1 ton of the carbonate process mixtures.

The strength of zircon shells can be made equal to that of silica shells by using less than half the weight per cent of resin due to better packing, smaller surface area (round grains) and greater affinity of zircon for resin. This results in a saving on resin cost which may vary from 10 to 20 per cent (or even more) depending on the grade of silica sand used.

Materials of the composite molds probably would not be reclaimed, and the total cost of refractory discarded would be \$1.66 +\$3.12 + \$1.46 = \$6.24. Considering zircon, if the cost of reclamation was \$1 per ton, the recovery would have to be about 96 per cent to equalize the costs of refractories. In fact, the cost of the reclaimed zircon would then be \$2.00 + (4/100 × 106.00)

TABLE III—Comparing Sand Mix Costs

The material cost figures used in the calculations are as follows:

Zircon sand	\$53.00/ton
Silica sand (facing)	10.00/ton
Silica sand (backing)	5.00/ton
Granulated limestone	7.00/ton
Coating resin (65% solid)	0.28/lb
Dry mix resin powder	0.27/lb
Manganese dioxide powder	0.05/lb
Iron oxide powder	0.03/lb

The basis of comparison is as follows: 2 tons zircon vs. 1/6 ton facing sand +5/6 ton backing mixture

25.00%	limestone in backing mixture
5.00	resin in backing (dry)
3.50	resin in facing (coated)
1.50	iron oxide in facing
1.50	resin in zircon (coated)
0.75	manganese dioxide in zircon

The costs of the molding mixtures are:

For zircon molds:

Zircon	$2 \times \$53.00$	= \$106.00
Resin	$4000 \times \frac{1.5}{100} \times \frac{100}{65} \times \$0.28$	= 25.84
MnO_2	$4000 \times \frac{0.75}{100} \times \$0.05$	= 1.50
	Total	\$133.34

For Chilmet molds:

Facing		
Silica sand	$1/6 \times \$10.00$	= \$1.66
Resin	$\frac{2000}{6} \times \frac{3.5}{100} \times \frac{100}{65} \times \$0.28$	= 5.02
Fe_2O_3	$\frac{2000}{6} \times \frac{1.5}{100} \times \$0.03$	= 0.15
		\$ 6.83
Backing		
Sand	$5/6 \times 0.75 \times 5.00$	= \$ 3.12
Limestone	$5/6 \times 0.25 \times 7.00$	= 1.46
Resin	$5/6 \times 2000 \times \frac{5}{100} \times 0.27$	= 22.50
	Total	\$27.08
		\$33.91

or \$6.24, neglecting amortization of the capital initially invested in the zircon.

The saving of resin in the zircon sand operation is \$27.52 − \$25.84, or \$1.68, per ton equivalent of shell molds. This saving would be lost, however, if the recovery of zircon should drop to less than 96.0 per cent. In fact, at 96.0 per cent recovery, the cost of the zircon mixture would be \$2.00 + \$6.24 + \$25.84 + \$1.50, or \$35.58, as compared to \$33.91 for the Chilmet mixtures.

All that could be saved with zircon, assuming 100 per cent recovery of the material, is \$6.24 − \$2, or \$4.24 on refractories and \$1.68 on resin, minus \$1.35 additional cost in oxide additive, or a total saving of \$4.57 per ton equivalent of shell molds. It is, of course, impossible to realize 100 per cent recovery.

Conclusion — Although this article has dealt only with use of the Chilmet Process for making low-carbon and low-alloy steels, advantages also are expected to result from its use in casting high alloy steels, phosphor bronze, and other metals which benefit from the chilling action and thermal shock resistance of the composite molds.

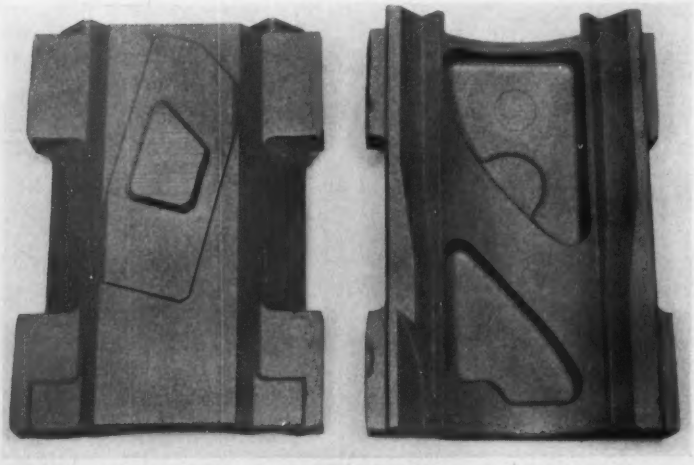

Fig. 9—Rocket slide castings of 4340 steel cast in Chilmet molds. Casting on left has cope side up; other casting is drag side up

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STANDARDS ARE NEEDED FOR . . .

SURFACE FINISH OF CASTINGS

Fewer standards exist for surface condition than any other aspect of casting production, yet surfaces are becoming increasingly important as new finishing processes are developed

● HOW does anyone determine surface condition on a casting? Is it done by appearance or test or "feel" or what? How smooth is smooth? How rough is rough? What standards are both accurate and practical to measure these highly relative terms?

These questions—and thousands more just like them—for many years have been hard lumps in the foundryman's bed.

Except in a few isolated instances, casting users have no exact, industry-wide method of specifying the finish needed for a particular job. Where such standards do exist, they are principally the result of trial and error. For example, sanitary ware producers require a deeply etched finish for good porcelain adhesion. Perhaps some other finish condition would be as good or better, and could be produced at far lower cost, but the deep-etch is known to do the job. How deep should it be? Requirements vary, at least partially, because no one has a set of scientifically formulated standards as a guide.

Neglected Subject—Fewer standards exist for surface condition than any other aspect of casting production, yet surfaces are becoming more and more important as new finishing processes and techniques are developed and competition among foundrymen increases.

Specific industry-wide standards exist—and are followed—in virtually every other precision metalworking industry. The screw machine products industry and other groups which machine metal, for example, have very definite surface finish standards which generally are as important a specification as outside and inside diameters, thread pitch, and so on. A number of very accurate and relatively simple surface gaging tools are used. Surface finish indicators, which determine the smoothness of machine surfaces in microinches, are a good example.

These surface indicating devices generally consist of a stylus, amplifying unit, and meter. They work perfectly on machined surfaces, which have a regular, measurable pattern of peaks and valleys. Specially modified models, with special stylus designs, have been tested on steel castings with only

a small degree of success.

Results of such testing have shown that the human element is too important a factor in measurement: Readings on the same surface vary greatly when different people use the same device.

Some foundrymen report that they use shot or grit mainly to remove sand from castings prior to machining and are completely uninterested in the finish itself since no special processing is indicated. Even so, it is only sound economy to find out what size and type of abrasive will remove the sand or other foreign matter at the lowest over-all cost.

A thoroughly recognized set of standards could also help eliminate the expensive overcleaning and overspecifying now done "just to be on the safe side."

To say that no problem exists is at best wishful thinking. The problem does exist; we just haven't yet recognized it.

Although published industry standards certainly are desirable, it might well be less than fortunate if some casting user group or industry were to introduce a set of surface finish standards for our industry's use. Standards for the entire range of castings can best be developed by foundrymen themselves—and should be developed now.

Aluminum Standards—The aluminum casting industry had no set of surface standards until a few years ago. Then the aircraft industry users got together and set up standards for the casters to meet. These standards, which measured surface roughness in terms of microinches, were widely considered unrealistic. Still, because of the user group's insistence, they were adopted for the aircraft industry and may in the future be adapted for use by other users of aluminum castings.

Assuming that a practical, workable set of standards for finish conditions is desirable, why do we not now have such standards? One reason is that research work is needed, and the total expense is probably more than any one company could reasonably spend. As Charles Walton, technical director of the Gray Iron Founders' Society, says, "All the easy jobs have been done. It is inevitable that from now on the problems become more complex, and finding solutions become more expensive."

The difficulties involved in setting up such standards are impressive, but not overwhelming.

The complexity of the problem is evident in the first step of setting standards—identifying and cataloging the infinite number of degrees of roughness and smoothness.

How To Proceed?—What divisions should be made? Should it be set up with some arbitrary numercial system, much as sandpaper textures are classed? Is there some measuring system? Assuming that surfaces could be measured in microinches, what about the degree of roughness within the small valleys? What measuring techniques should be specified? How large an area should be measured? Would a profile cross section be sufficient?

In addition to the problem of defining terms to describe finish condition, many problems arise in the variables of casting production itself. For example, two castings from the same pattern, using the same metal, could easily have different as-cast conditions if they were produced by two different foundries. The difference might be slight, but it could be enough to introduce another variable.

Even more variables exist in blast cleaning equipment, shot or grit type, length of cleaning cycle, distance and direction of abrasive throw, and exact nature of the operating mix.

In any discussion of blast clean-

PEARLITIC MALLEABLE ABRASIVE

	Shot Sizes						Grit Sizes				
	S-1320	S-780	S-660	S-460	S-390	S-330	G-10	G-14	G-18	G-25	G-50
COPPER ALLOYS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
STAINLESS STEELS	[illegible]										[illegible]
MEDIUM MANGANESE STEELS	[illegible]										[illegible]
NICKEL CHROME STEELS	[illegible]										[illegible]
SILICON STEELS	[illegible]										[illegible]
GRAY IRON	[illegible]										[illegible]
WHITE IRON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NODULAR IRON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

A chart of this nature, filled out for each type of abrasive, would show precisely what finish would be obtained with that abrasive under standard conditions. Coding would be by letter or number or both, and would be keyed to sample plates for instant manual and visual comparison.

ing, it should be kept in mind that the finish produced on a given piece of metal is more a function of the operating mix than of the size abrasive first introduced into the cleaning machine. The reason is that all metal abrasives break down in use after repeated impact. They break down into halves, quarters, eighths, and so on, rather than from full size particles into dust.

For example, in a blast cleaning machine running No. 460 size shot, only about 25 per cent of the operating mix is standard No. 460 size. The balance is made up of smaller particles ranging down to the size being exhausted.

Various Sizes Needed—To keep just one size abrasive particles in the machine woud require almost immediate exhaust of broken particles. With exhaust naturally comes replacement, and this approach would be prohibitively expensive. In addition, it probably would deliver a poor finish since both large and small particles perform a function within the operating mix: Small particles give coverage; large particles provide impact. It is, therefore, the operating mix which determines the finish, and operating mix is determined by abrasive breakdown rate and exhaust setting.

A chart such as this would set forth various roughness standards which would be keyed to engraved plates, each with a different degree of surface roughness. The chart would show what sort of finish would be produced on a given metal subjected to a standard set of cleaning conditions

Another variable factor in setting standards and writing specifications is the wide range of sizes and hardnesses of abrasives available within the industry. Add to this the wide assortment of commonly blasted metals, with their own almost infinite variations of hardness and ductility, and the seemingly simple problem looms larger.

Then, just to complicate matters, the question arises of how to publish or otherwise distribute usable standard samples to interested parties.

One Suggestion—One method of delivering some standard, scientifically produced data is through the use of a large but simple chart, like the accompanying one, in conjunction with engraved plates much like those used in letterpress printing. The plates, which would be flat, and might measure 4 x 5 in. or some other convenient size, could be keyed to the various roughness standards set forth in the chart, providing an accurate visual and fingertip comparison method.

The chart would serve to show precisely what sort of finish would be produced on a given metal when subjected to a standard set of blast cleaning conditions with a specific size, style, and type of abrasive. While this method might not be 100 per cent accurate, it easily could be a step in the right direction. Although it might be necessary eventually to have dozens of engraved plates and literally hundreds of charts, at least the information could be available and used as a sound guide.

Although the problem of finishes is not a simple one, it is by no means insoluble. The big problem is in finding out exactly what has to be learned. Once objectives are clearly drawn, the mechanics of scientific testing are relatively simple.

The idea of *scientific* testing is most important. Much of the present knowledge of abrasive performance has been accumulated by on-the-job testing, by a plant engineer or cleaning room foreman or by suppliers of abrasives. Such testing naturally has been in problem-solving, and not in setting up industry-wide standards on a purely scientific basis.

For example, in nonferrous metals, typical industry practice is to stay in size ranges S-330 shot and under and G-40 grit and smaller, with the finer finishes requiring proportionally smaller abrasive particle sizes.

For stainless steels, as well as the manganese, magnesium, silicon, molybdenum, and nickel-base alloys, general practice is to use the largest abrasive sizes possible, in line with desired finish. S-780 shot and G-10 grit, or a combination of both, frequently are used for good, heavy cleaning. Here again, for finer finishes, S-330 shot and G-40 grit might be indicated.

In the area of gray, white, and nodular iron castings, by far the most common types, industry practice most frequently is to stay with shot sizes in the range of S-390, S-460, and S-550. More than 55 per cent of all castings within this group are blasted with these sizes since they provide both adequate cleaning and good surface finsh.

Many other castings within this area are finished with grit in sizes from G-25 to G-14, particularly where paint or enameling processes follow.

The fact that most abrasive use is centered on these relatively few sizes of abrasives should be significant. It should also help narrow the initial exploratory work and, incidentally, prove the value of having positive standards.

All Would Benefit—Users and producers of castings and other metal parts which require abrasive cleaning would benefit greatly from a thorough scientific study of the action of metal abrasives on various metals. The study would eliminate trial-and-error abrasive selection and could aid users materially in picking the one best size, style, and type of shot or grit to do the best job.

There is no doubt that standards are needed. There is no doubt that they can be produced through industry co-operation and research. Where do we go from here?

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Centrifugal Casting

Physical forces characterizing the process are explained concisely. Casting machines and production techniques are described. A discussion of requirements of alloys used in metal molds and of mold wash materials concludes this first of two articles reviewing centrifugal casting literature to date

● CENTRIFUGAL casting is an all-embracing term and refers to any casting that has been rotated during the solidification period. There are, however, three types of centrifugal castings: 1. True centrifugal castings, such as cast iron water pipe. 2. Semicentrifugal or profiled centrifugal castings, e. g., pulleys and sheaves. 3. Pressure castings, e. g., a nest of castings arranged symmetrically around a common sprue.

The latter two types usually are special cases of sand castings produced in conventional ferrous and nonferrous metals.

This review of literature discusses principally the true centrifugal casting of iron and steel. If applicable points of interest occur in the other methods, due acknowledgment will be made.

Previous reviews of the subject have appeared from time to time and, in particular, Reference 1 is a complete bibliography up to 1949. Donoho, Weber, Zuehlke, Janco,[2] and Loshkarev,[3] Polzguter,[4] and Wallace[5] also have made significant contributions to the literature. This review will bring the previous studies up to date.

The principles of centrifugal casting first were enumerated in 1809 by A. Eckhard.[1] However, commercial applications of these principles were employed successfully only during the last three or four decades. Today, only two basic variations in techniques are employed to secure satisfactory castings. These variations involve either the mold system employed or the type of mechanisms used to obtain rotation, metal admittance, casting extraction, and other functions.

Theoretical Data—The basic requirement for horizontal centrifugal casting of tubelike configurations is that a force equal to or greater than the force of gravity, g, should be imposed upon the metal.

A convenient way of expressing the general case is as follows:

$$mr\omega^2 \geq mg \qquad (1)$$

where: m is the mass being considered
r is the effective mean radius
ω is the angular velocity
g is the acceleration due to gravity

This expression has been used frequently to determine the minimum revolutions per minute, N, required to centrifuge the molten metal. When combined with the equation to convert angular velocity to revolutions per minute,

$$N = \frac{60\,\omega}{2\pi} \qquad (2)$$

Thus, conveniently expressing the mean diameter, D, of the casting in inches, it can be shown that the minimum value of N is (approximately):

$$N = \frac{265}{\sqrt{D}} \qquad (3)$$

The centrifugal force, F, acting upon the mass of metal, m, can be shown to be equal to:

$$F = \frac{m}{g}\,\frac{4\pi^2 N^2 r}{12} \qquad (4)$$

The above expression, of course, represents the idealized case and neglects the effects of gravity and wall friction. Diepschlag[6] and Schwartz[7] have studied the influence of these two factors on the mathematical solution for the effective forces active. In this case the centrifugal force must overcome gravity and friction for every point in the rotation; consequently, an asymmetrical force distribution will exist during rotation. The degree of asymmetry will depend on the contribution of wall friction, internal friction, and gravity.

A similar mathematical treatment by Vilyum[8] of a centrifuged, heavy viscous liquid also has led to an equation for calculating the distribution of liquid around the internal periphery of the mold. From the equations derived it was concluded that the cross section of the free

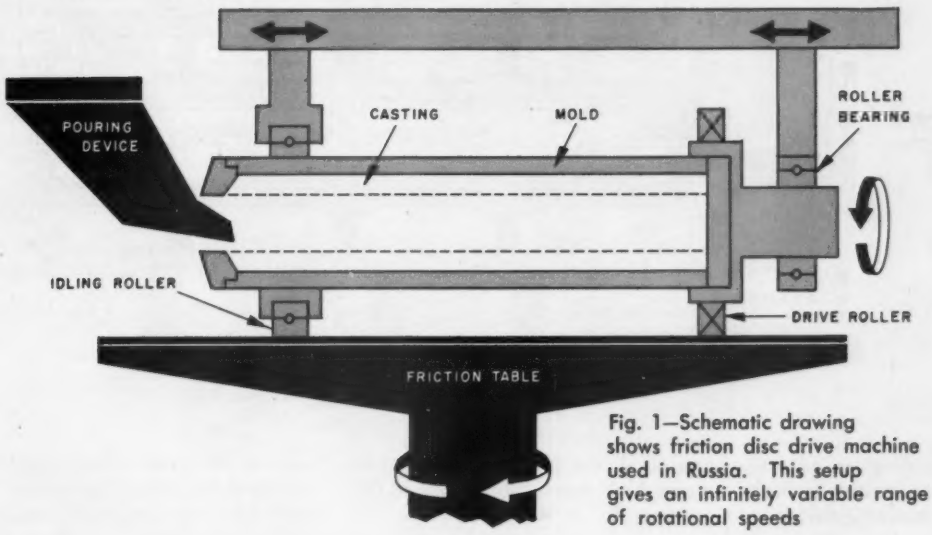

Fig. 1—Schematic drawing shows friction disc drive machine used in Russia. This setup gives an infinitely variable range of rotational speeds

surface will not be circular. The layer will be thin at the bottom and thick at the top.

Wiesner,[9] considering only the effects of gravity, also made a similar conclusion; however, he added that in metals, as opposed to viscous nonfreezing liquids, the rapid increase in internal friction (viscosity) subsequent to pouring facilitates the casting of tubes of uniform wall thickness.

Use Empirical Values—The use of refined theoretical treatments to obtain optimum rather than the minimum values of N (required revolutions per minute) does not appear to be widespread. Empirical values, however, are in relative abundance. The deviation of these empirical values results from the wide divergence of liquid metal properties in addition to the influence of different mold systems.

These can be illustrated by the variations in viscosity with temperature; steel viscosity, in particular, depends strongly on casting temperature and composition. The frictional effects resulting from the use of sand-lined molds obviously are different from those operating in all metal-mold systems.

Consequently, only the very roughest guide can be provided by the foregoing highly simplified relationships (namely, equations 1, 2, 3, and 4). It therefore is not altogether surprising to find in the literature the various empirical values for required acceleration, rotational velocities, and other functions, and occasionally an empirical relation such as that relating revolutions per minute to mean radius.

The following example illustrates the marked difference between the results predicted by the approximate formula of Equation (3) and that determined from an empirical relationship given by Wiesner.[9]

$$\text{Approximate Formula: } N = \frac{265}{\sqrt{D}} \qquad (3)$$

For 6 in. diam pipe, N = 108 rpm

Empirical Formula:

$$N = \frac{1675}{\sqrt{r}} = \frac{2370}{\sqrt{D}} \qquad (5)$$

For 6 in. diam pipe, N = 967 rpm

TABLE I—Differential Metal-Slag Densities

Particle	(Iron Density, $\rho_2 = 7.1$) Density of Particle ρ_1	Density Difference $\rho_2 - \rho_1$
SiO_2	2.3	4.8
$FeO.SiO_2$	3.0	4.1
$MnO.SiO_2$	3.6	3.5
Al_2O_3	3.9	3.2
MnS	4.0	3.1
$2MnO.SiO_2$	4.1	3.0
$2FeO.SiO_2$	4.3	2.8
FeS	4.6	2.5
MnO	5.5	1.6
FeO	5.9	1.2

Apart from holding the metal upon the walls of the mold, Wiesner's relationship also apparently favors separation of the nonmetallic and small slag particles.

The separation of slag and nonmetallic inclusions has been studied in part by Hartmann[10] and obeys Stokes' Law.

$$u = \frac{2r(\rho_2 - \rho_1)f}{9\eta}$$

where: u = velocity of movement of particle
r = radius of particle
$\rho 1$ = density of particle
$\rho 2$ = density of liquid metal
f = acceleration experienced
η = viscosity of liquid metal

Assuming a particular liquid metal and temperature (assigning values for ρ_2 and η, for molten steel) and assuming slag particles of equal size, then a silica particle will move three times as fast as a particle of manganous dioxide. This arises since the density difference ($\rho_2 - \rho_1$) is 4.8 in the case of the silica and 1.6 in the case of the manganous dioxide. Benedicks and coworkers[11] have tabulated values of this term ($\rho_2 - \rho_1$) for various substances in steel as shown in Table I.

A Tip on Deoxidation—It is obvious, from the variations in the density difference terms above, that this separation effect is real and

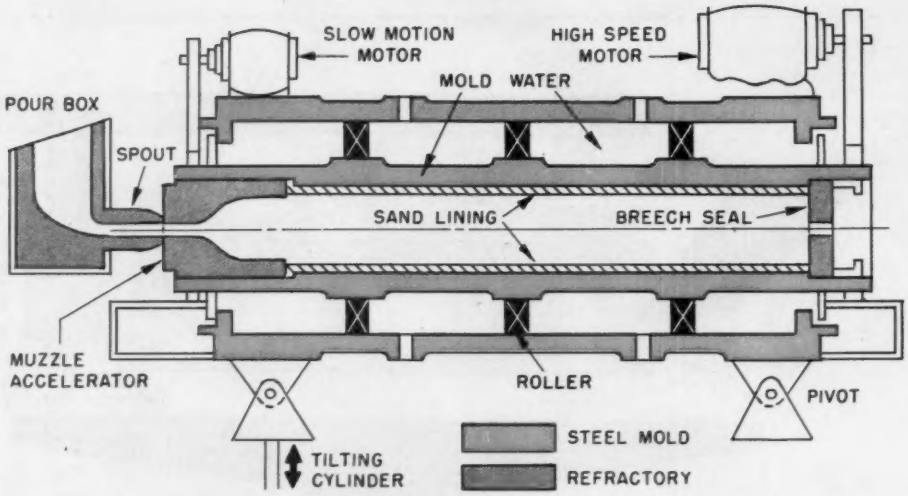

Fig. 2—German gun-tube casting machine is driven by a 125-hp motor through a train of gears

that centrifugal casting is advantageous. In addition, insofar as steel is concerned, the marked differences in both density and particle size of these nonmetallic particles indicate the direction in which deoxidation practice should be pursued in the steelmaking technique.

The theoretical influence of pouring factors—such as the interrelation of kinetic energy of the metal stream, angular velocity of the mold, and the frictional factors mentioned earlier—has not been studied in great detail. However, one exception is a recent paper by Khakhalin and coworkers[12] who have considered these problems. In particular, they have attempted to show that a correlation exists between variation in wall thickness and peripheral velocity at various distances from the pouring end of the mold.

The majority of the preceding comments apply only to horizontal centrifugal casting. It should be added at this point that the choice of the attitude of the axis of rotation is governed principally by length-to-diameter ratios.

The vertical process lends itself particularly to the production of tubes of smaller length-to-diameter ratios. Again, simplified mathematical approaches have been pursued to determine interrelation of revolutions, diameter, and wall thickness. Although this treatment is generally satisfactory, it is understood that the free surface is roughly approximated by a paraboloid.

In summary it can be seen that formidable gaps still exist in the literature, especially as to the reasons for the difference between theoretical values for rotation requirements and the values employed in practice.

CASTING MACHINES

The basic requirements of any centrifugal casting machine may be enumerated as follows:

1. The mold must rotate at a predetermined rate.
2. Metal must be admitted to the rotating mold.
3. After the metal is admitted and distributed in the mold, the correct mode of solidification must proceed.
4. The casting must be extracted from the mold.

Rotation of Mold—Two methods of rotation generally are adopted: 1. Direct drive by pulley or gear arrangement positively attached to the mold. 2. Indirect drive by tires affixed to the mold and driven by rollers or friction disc devices. In the case of cast iron centrifugal casting practice, the DeLavaud Process is most typical of direct drive. Gears usually are employed to transmit motion from the motor to the mold, but in certain instances V-belt pulley drives have been employed. The advantages of the gear drive in high-production work are obvious.

With regard to centrifugal casting of tubular steel castings, similar arrangements have been employed. For example, the German centrifugal gun-tube casting machine used by Watertown Arsenal[13] has a train of herringbone gears driven by a 125 hp motor located on the nonpouring end. Of secondary interest in this particular machine is the small motor located at the pouring end of the mold which originally was used for coating the mold. The first American gun tube machine employed at Watertown Arsenal relied upon chain drive of a driving spider attached to the mold.[13]

The indirect-drive device has considerably less engineering complications than the direct-drive system. The mold is positioned so that the tires are in contact with the driven rollers. The number of tires and driven rollers employed depends upon the length of the mold. Contact between mold and rollers is maintained by gravity only[14] or by pressure of idling rollers at positions diametrically opposite to the driving rollers.[15]

Russian investigators have made considerable use of friction disc drives[16] for short-length (25 in.) and relatively small diameter (5 in.) requirements. It is of particular interest to note that this arrangement gives an infinitely variable range of rotational speeds, see Fig. 1.[16] In addition, a rotation of the whole mold on an axis normal to the centrifuging axis can be imposed in variations upon this general engineering arrangement. The latter arrangement would appear to facilitate the production of hollow-cupped ingots.

Hold-down and centering rollers normally are employed in a nest of four rollers at 90-degree centers around the circumference of the mold. In conventional industrial machines these rollers usually are arranged so that a range of mold diameters may be accommodated. However, in certain heavy mold systems the uppermost sets of rollers

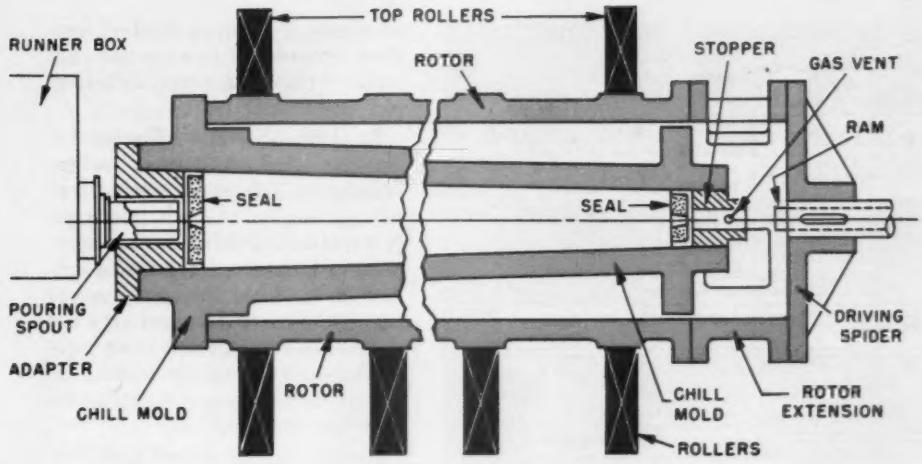

Fig. 3—Standard American gun-tube casting unit is rotated by a driving spider

are omitted and the mass of the mold and its contained metal is relied upon to maintain contact with the drive rollers.[17,18]

The relative advantages of the direct system are contained in the positive control over acceleration, deceleration, and rotational velocity. Uncontrolled vibration of the mold in the indirect drive system also may be a problem.

Pouring the Mold—The only two possible methods of admitting metal to the mold under controlled conditions are:

1. Admittance of metal from fixed pouring devices located at one or both ends.

2. Admittance of metal from a launder which itself retracts, or the mold retracts, and the metal is deposited from it in a continuous spiral upon the mold wall.

The rate of metal delivery in both methods is controlled carefully by programmed hydraulic or mechanical devices acting upon quadrant ladles.

In the case of thin-walled cast iron pipe (DeLavaud), the launder technique is claimed to produce castings with minimum thickness variations. This claim is supported by practical experience. It also is generally accepted that, so far as thin-wall castings are concerned, this technique produces castings with few cold laps and similar pouring defects. Because of this latter reasoning, where all-metal molds are employed, the launder method is favored.

The launder method, however, requires that the mold be positioned in some attitude other than the horizontal. Also, the rate of extraction of the launder for a mold must be controlled to take full advantage of the system.

The fixed pouring spout, lends itself to production of thicker walled castings in all metals, e.g., thick-wall steel tubing and gun barrels. It is particularly applicable where sand or refractory-lined molds are encountered and cold laps are likely to occur. Records show that tubing and pipe of about 20 ft have been cast with this pouring technique.

In the case of cast iron, soil pipe 4 in. in diam x 18 ft long has been made[17] and, where steel is concerned, stainless steel pipe[18] and gun tubes[15] are produced of similar lengths but usually of larger diameters and thicker sections.

Mold Cooling—Solidification of the metal is a metallurgical topic and will be discussed in a later section. The means available for the controlled extraction of heat from the casting are the mold proper and any external cooling medium. Three main types of external cooling have been employed: Air cooling, water spray cooling, and water bath cooling.

Air cooling is generally of the normal convection variety associated with thick-walled chill molds or sand-lined molds. Reference 13 shows examples of the former, and References 17 and 18 show examples of the latter. The rate of heat extraction by this medium is only of secondary importance in influencing rate of solidification.

Water spray cooling is fairly common in short-run production machines. It can influence the mode of solidification, but economic considerations probably dictate its use. The design of machines which employ this system is simplified considerably when compared to water-jacketed mold machines. The ease of mold removal, lubrication conditions, and mold sealing are favorable factors in the water spray system. Iron and steel castings are produced in machines cooled by a water spray.

The use of water-jacketed molds probably is most common in high production rate applications. The DeLavaud process is a typical example of this method. The mold thickness in this system usually is much less than in other systems. In this instance, the external cooling water exerts a major influence upon heat extraction rate from the casting. The rate of heat extraction is governed by the flow rate and temperature of the water and by jacket design. Water-jacketing has many engineering complications.

Casting Extraction—Several methods of extracting solidified castings from the mold are employed. These methods generally hinge upon casting design and the production system employed. As an illustration of the first factor, in the DeLavaud Process a puller device withdraws the pipe from the bell end of the mold, and in the case of the original Watertown Arsenal gun tube process the casting is ejected from the mold by a hydraulic ram.

Illustrative of the second factor, extraction from the mold is performed in the casting position (e.g., DeLavaud), whereas in other proc-

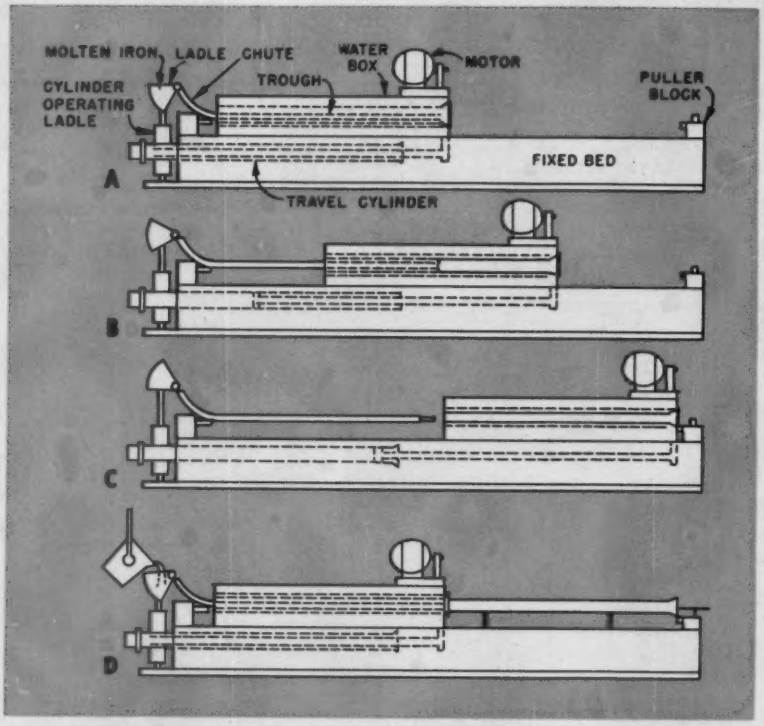

Fig. 4—Operation of a DeLavaud pipe-casting machine. The steps are: A. Ready to pour. B. Pouring. C. Pouring completed, casting ready for ejection. D. Casting ejected, ladle being filled

esses separate stations are available for the extraction operation. References 17, 18, 19. In the latter processes a high production rate is obtained by the use of many molds in conjunction with such devices as overhead magazine loading at the casting station.

In concluding this discussion of the various major points in centrifugal casting machines, a number of schematic drawings are given in Fig. 2, 3, 4, and 5.

TYPES OF MOLDS

Permanent Molds—Steels of various analyses and cast irons have been employed for permanent molds for centrifugal casting of both iron and steel shapes.

The application of cast iron molds appears to be only of minor importance insofar as steel casting production is concerned. The strength limitations of cast iron are obvious. Erosion of the mold is probably also a limiting factor. Finally, the relatively lower thermal diffusivity of the cast iron is also a deterrent to its use.

An instance, however, of the casting of steel boiler drums is contained in Reference 20, wherein hematite cast iron molds were employed. Some economic advantages, however, obviously are apparent in the use of this material for very large diameter, short-run castings. In certain instances gray cast iron is employed for molds in high production rate plants producing cast iron soil pipe and similar shapes.

It is claimed that the major considerations governing the choice of this particular mold material are initial economic cost, "inherent resistance to thermal cracking," ease of in-plant manufacture, and lack of distortion.[17] The preferred analysis is referred to as "similar to that of molds used for making steel ingots."[17]

The use of steels of various analyses for permanent molds for centrifugal casting probably is more widespread than the use of gray cast iron. The demands made upon steel are similar to those made upon cast iron and, again, frequently are governed mainly by production rate and method employed in casting. For example, the thermal stresses experienced in the DeLavaud process obviously are quite different from those encountered in air-cooled chill molds utilized in, say, high-alloy pipe manufacture.

Describes Stresses — Koniger[21,22] has described the stress system existing in chill molds during centrifugal casting of gray iron pipe. It is understood that the initial compressive stresses on the inside surface of the mold frequently exceed the flow stress of the material, while the stresses on the cooler outer layer (in tension) are purely mechanical and therefore do not normally exceed the yield point.

Apparently, for normal gray iron practice at normal pouring temperatures, a compressive stress adjacent to the surfaces reaches within 5 seconds 25 kg/mm² (35.6 kpsi) before eventually being converted into a tensile stress of 80 kg/mm² (114 kpsi) after about 2 minutes.

This author[22] went on to examine the effectiveness of various alloying elements upon mold durability. In the process of this investigation a good correlation between the effect of tempering between 500° and 700° C (932°-1292° F) for 100 hr upon notched bar impact resistance and actual mold durability in practice. Apparently molybdenum additions from 0.42 to 1.05 per cent were "most preventive to the thermal change." Other elements studied were carbon 0.1 to 0.25 per cent, chromium 1.1 to 2.4 per cent, vanadium 0.1 to 0.4 per cent, and nickel none and 0.4 per cent only.

A similar correlation of mold life with notch impact toughness has been reported by another German worker, Bühler.[23] Long-time studies of mold life involved steels containing 1.8 to 2.7 per cent Cr and 0.3 to 0.6 per cent Mo. It is significant to note that, in general, lower strength steels showed better resistance to surface cracking.

Much of the mold material used in the DeLavaud process has been forged SAE 4130, tempered to 25 to 30 Rc. The use of this relatively high strength material is, of course, governed by the high thermal stresses experienced in water-cooling the exterior of the mold shell. Although the pouring temperatures and speeds normally are higher with high-alloy casting practice, a preference appears to exist for lower alloy materials such as SAE 1010,

1020, and 1040. The principal mold choice generally is 1020. This preference is dictated partly by economic reasons—for example, higher molten metal cost. No doubt, the production rates and cooling practices involved have a strong influence here.

Counteract Thermal Stresses—The problem of thermal stresses has attracted much attention, since they lead to crazing or checking and often eventually to propagation of major cracking. To counteract these effects various mechanical devices have been sought, such as grooving, etching, and grooved or plain inserts. Although partly metallurgical in nature, shot peening, burnishing, and indenting are employed in a similar role.

The principles underlying the majority of these surface treatments are not particularly obvious. However, where surface treatments which involve cold working (e.g., shot peening, indenting) are employed, the metal so treated will have an increased yield strength. The effects of cold working upon the strength are probably only temporary.

The purely mechanical notches such as obtained by grooved networks or etching are understood to lead to a controlled, localized surface cracking. If this cracking is of optimum frequency, the notches can be beneficial to the over-all life of the mold. The interrelationship of factors such as optimum flow stress, grain size, microconstituents, the exact role of stress raisers and/or expansion-limiting devices obviously requires clarification by carefully planned research. These surface treatments also help in obtaining good adherence of mold washes to the mold surface.

References 24, 25, and 26 are to patents which deal with techniques for surface treatment of molds such as those described above.

Mold Washes—Both dry and wet washes are used widely in the industry. The dry washes principally are ones involving ferrosilicon and graphite, singly or combination, for cast iron production. These materials may be dusted on ahead of the pouring stream[17] or may be placed before casting. In addition to any parting or protective role this mixture may have, the graphitizing influence of such materials also must be considered. Furthermore, the preferential reaction of the ferrosilicon with any iron oxides on the mold face is liable to be involved in the use of the dusting technique.

Wet wash applications normally are composed of a refractory medium, e.g., graphite, plumbago, silica flour, and/or zircon flour, suspended in suitable media. Bentonite-water mixtures are common suspension media, and the addition of materials such as sulfite lye, linseed oils, sodium chloride, and magnesium sulfate also is common practice. The latter additions usually are made to control blistering and adhesion of the wash to the mold surface.

Silica flour and zircon flour base mixtures normally are employed when steel is cast. The use of graphite and plumbago is prohibited because of their carbonizing effect on steel and the propensity to gas generation which could result in pin holes when these materials are used as protective agents.

(To Be Concluded)

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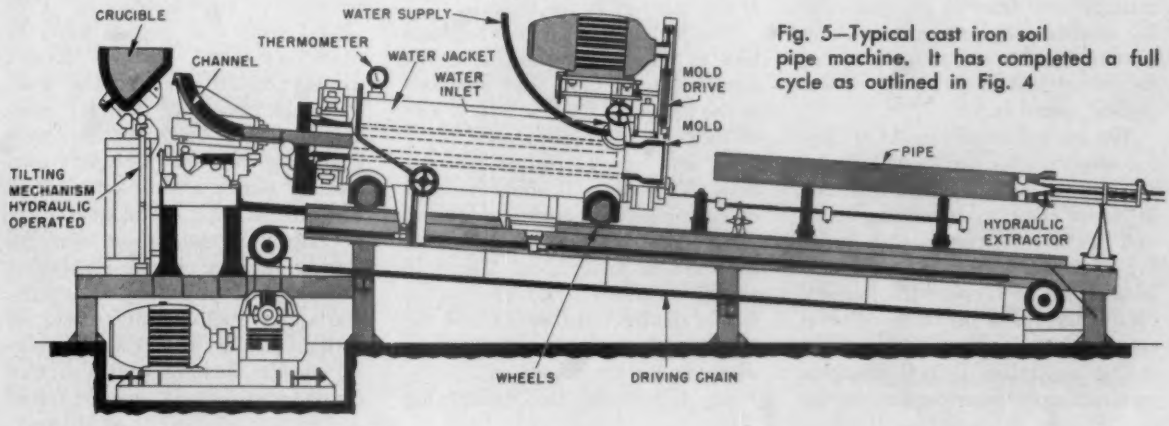

Fig. 5—Typical cast iron soil pipe machine. It has completed a full cycle as outlined in Fig. 4

Closely Controlled Brinell Hardness

Increases Castings

A midwest foundry holds Brinell within ± 20 points by closely controlling iron chemistry and casting cooling time in the mold. This has been a major factor in reducing customer returns to less than 1 per cent

Brinell hardness tests are made on four castings from each molding line every hour as part of the control program

● CONTROLLED Brinell hardness in gray iron castings has been a major factor in reducing customer return scrap to less than 1 per cent at Midwest Foundry Co., a division of L. A. Darling Co., Coldwater, Mich. Dollar value of customer returns for ten months this year was less than half that of a similar period in 1960.

Management at Midwest is convinced that most of this improvement results from the foundry's ability to control Brinell hardness within a ±20-point range without difficulty. But a higher quality iron now being produced, and better worker morale resulting from a management drive to improve casting quality and employee working conditions, also are pointed out as factors contributing to the lower casting return rate.

The general improvement in casting quality level brought about by all these factors has been reflected in lower foundry operating costs and has been instrumental in building customer acceptance and satisfaction and in keeping the foundry competitive in a period of general recession.

The controlled Brinell hardness results simply from regulating the time that castings cool in the mold before they are dumped out. The decision to seek a method for controlling Brinell resulted from a concerted drive by foundry management to reduce customer returns and thereby enhance the foundry's reputation as a supplier of high-quality, reliable castings.

Studied Customer Rejects — A close study of the records of defective castings returned by customers showed that variance with the Brinell hardness specification was a major cause of rejection. Foundry engineers felt that hardness was affected by two major factors—chemistry of the iron and cooling time of the castings in the mold.

The first step to control hardness was to narrow the ranges of the constituents in gray iron produced at the foundry. Carbon now is 3.40 ± 0.05 per cent; silicon is 2.10 ± 0.05, and manganese is 0.80 ± 0.05. That range is about half the maximum permitted previously. Iron within the control limits shows a chill of 8/32 to 10/32 in. Depth of chill is measured lengthwise on the face of the fractured wedge, and the iron sample is taken at the point where molds are poured.

An interesting fact concerning chilling of the iron showed up in the melting control record charts. Depth of chill on the iron went up whenever the cupola air blast rate was increased. As a result, adjustments to the blast rate are made gradually in increments of no more than 100 cfm. The bed height is adjusted accordingly with each change in the blast rate.

Cupola Charges—On the theory that the iron which comes out the spout can be no better than the raw materials that go into the stack, management decided to go all out on the quality of charge materials. The steel scrap component consists only of plate and structural material of known analysis. Purchased scrap iron consists solely of machine shop rejected blocks, heads, and other automotive iron. Premium prices are paid for these components. High-quality merchant pig iron and Midwest's own foundry remelt are the other metal constituents of the charge.

Control is maintained over incoming supplies of coke by keeping it segregated according to vendor. Variations such as differences in carbon pickup which would show up on the melting control record charts, consequently, can be traced

Acceptance

By ROBERT H. HERRMANN
Associate Editor

A foreman sets a timer which controls the casting cooling period on one of the 14 mold indexing cooling lines

back to the vendor who supplied the coke.

Twenty 1000-lb charges are dumped in the 48-in. ID cupola each hour. A cylinder block is included in every other charge, and no particular difficulty has been encountered with this rather large scrap component.

Despite the higher cost of charge materials brought about by the quality improvement program, the cost of iron per pound of saleable castings has been reduced approximately 25 per cent.

Brinell Control — Previous attempts to control Brinell hardness of castings produced at Midwest were based solely on the use of additives to the molten iron. Alloying agents still are used to achieve specified requirements in certain castings. The major tool, however, in controlling Brinell hardness is regulation of the cooling time of a casting from the moment it is poured until it is shaken out of the mold.

That control is achieved by automatic equipment on 14 mold cooling lines. Each line consists of a pair of rails on which ride wheeled pallets containing two or three molds, depending on size. Molds are set on the pallets by the molder at each of the 14 jolt squeeze molding machines. Loaded pallets are pushed toward a walkway which crosses the 14 sets of rails at about the midpoint of their length.

Molds are poured here from ladles suspended from a monorail loop. Jackets are removed from the molds as soon as the metal has solidified, and the loaded pallet is pushed along the rails to a point where a notch in the rails holds the pallet in position to be indexed over a predetermined time to the dump-out. This is the cooling section of track, and space is provided for ten pallet-loads of molds. All ten are indexed simultaneously.

The pallets are indexed by dogs on a beam which is moved forward and backward in 30-in. strokes by an air cylinder. Frequency of the strokes is governed by a timer acting through solenoid switches to actuate the air cylinders. The cooling period for pallet loads of castings on a given cooling line can be set at any time interval between 13 and 45 minutes. The timing device is set by the foreman in charge in accordance with the cooling period listed on the production control sheet governing the job.

When a pallet-load of molds reaches the end of its cooling time, it is indexed to a tilting section of rails which tips by gravity to dump the mold and castings to an oscillating conveyor while retaining the bottom boards and pallet. An air cylinder tips the tilting section back to a lower set of rails on which the pallets return to the molders. The tilting rail section then realigns with the upper level.

Brinell hardness tests are made on four castings from each line each hour, and the readings are noted on a quality control report. If increasing or decreasing trends in hardness are noted, slight adjustments are made on the timing device of the cooling line to increase or decrease slightly the cooling time. Longer cooling times result in softer castings and, consequently, a lower Brinell hardness.

Castings are produced at the foundry for the automotive, refrigeration, and farm implement industries. Casting weights vary from less than 1 lb to 30 lb, and section sizes range from 3/16 to 2 in. The foundry pours about a hundred tons of iron per day.

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GATING Magnesium Diecastings

Successful gating systems for magnesium diecastings depend on proper control of the other process variables. Those variables and their control are discussed. A nomograph is presented to help in determining how to run a particular casting

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● A PARTICULAR gating system for a pressure diecasting is successful only when all of the other process variables are under control. Therefore, a discussion of gating must be based upon definite values for the variables normally encountered in the production shop. The first consideration is to establish the common ranges for the major variables and to select average base values in each case.

Alloy properties such as fluidity, heat content, thermal conductivity, solidification range, and casting temperature are of prime importance. Tables I, II, and III list numerical values which describe these properties for AZ91B alloy in comparison with the most common zinc and aluminum diecasting alloys.

Fluidity is lower in unclean, or cold metal, so one must assume that the mold will be supplied with properly refined AZ91B alloy at 1200° F. This value was chosen because it is in the center of the normal working range of 1180 to 1220° F.

Process Variables — A diecasting machine is a fairly complex piece of machinery, and it must be operated properly all of the time to get consistent results. If this is not done, additional process variables will be introduced which will nullify other good efforts. For example, the general practice is to charge the accumulator bottle with nitrogen to a pressure equal to one-half the operating pressure. If a slow leak exists at the top of the bottle, the nitrogen will be depleted, causing a gradual reduction in the injection speed.

Several other mechanical precautions must be taken with the machine to achieve good diecasting results with AZ91B alloy. Alloy steel shot pistons should be lubricated as required and the proper fit maintained to minimize friction or sticking. A clearance of 0.002-0.003 in./in. of diameter is satisfactory with H-13 steel equipment. With a straight-through shot well and copper beryllium pistons the fit can be more exacting.

During production the thickness of the biscuit should be maintained relatively constant at about one-third the diameter of the shot well being used. If the machine is locked up unevenly, or if the projected area of the casting is too great for the press, metal will spit out at the parting line at high velocities. When this happens a hot stream usually develops across the casting, causing a long defective area full of porosity and swirls.

Effect of Heat Input—Mold temperature is particularly important in the case of magnesium diecasting because of the relatively low heat input to the mold per cycle of operation, see Table IV. Most common castings must be produced at rates in excess of 150 cycles per hour to keep the mold up to the desired operating temperature of 450° F ±50° F.

TABLE I—Composition of Common Magnesium Diecasting Alloys

	AZ91A* (per cent)	AZ91B* (per cent)
Aluminum	8.3-9.7	8.3-9.7
Zinc	0.4-1.0	0.4-1.0
Manganese	<0.13	<0.13
Silicon	<0.5	<0.5
Nickel	<0.03	<0.03
Copper	<0.1	<0.3
Other impurities	<0.3	<0.3
Magnesium	Balance	Balance

*Ingot containing at least 0.0003 per cent Be should be used to minimize metal losses due to oxidation during processing.

TABLE II—Properties of AZ91A and AZ91B Alloys

Tensile strength, psi[1]	34,000
Yield strength, (0.2 per cent offset), psi[1]	23,000
Elongation, per cent in 2 in.[1]	3
Density, lb/cu/in.[1]	0.066
Thermal conductivity, Btu/hr/sq ft/°F/ft[2]	46
Heat of fusion, Btu/lb[4]	159
Mean specific heat (900-1200°F) Btu/lb/°F[3]	0.33
Thermal diffusivity, sq ft/hr[5]	1.3
Viscosity of Mg (1210°F), millipoises[6]	12.4
Freezing range, °F[3]	875-1105
Electrical conductivity, per cent of copper[1]	10
Normal casting temperature, °F	1180-1220

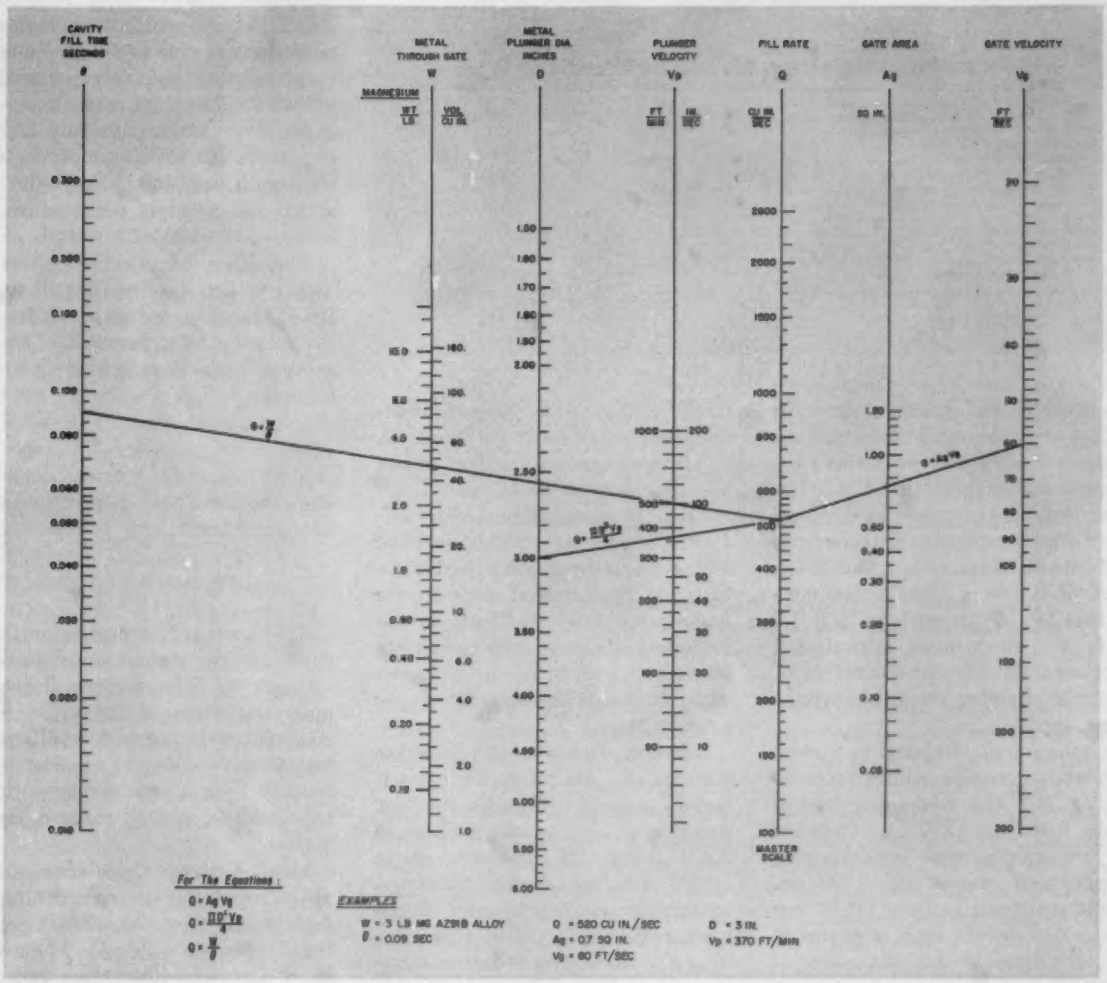

Fig. 1—Nomograph relates cavity fill time, metal volume, plunger diameter, plunger velocity, fill rate, gate area, and gate velocity for designing gating for magnesium diecastings

As an example, one might consider a 1-lb casting running at 150 shots per hour to release 300 Btu per shot, or 45,000 Btu per hour.[8] This heat input is sufficient to maintain the average die at temperature even though four water lines are used in the biscuit and runner areas. Depending upon the equipment available and the skill of the die designer, the same casting might be made at 400 cycles per hour at the same die temperature controlled by carefully placed water lines which would then remove a total of 120,000 Btu per hour.

It is obvious that process interruptions become increasingly serious as the output is raised because the mold temperature drops rapidly if the heat input stops. For short interruptions die temperature might be held to a satisfactory level by shutting off the cooling water. For long delays, however, heat may have to be supplied by an auxiliary burner which can be the same one used for preheating the mold.

Quality requirements of the casting to be produced determine many of the production conditions to be employed, and it is surprising how often these specifications are defined only sketchily. The American Die Casting Institute has recognized this condition by issuing their new commercial Product Requirement Data Standard "ADCI C9-61T," which covers such things as surface condition, pressure tightness, flatness, and dimensional tolerances as well as other special considerations.[9]

The part drawing defines the shape to be produced, which, in turn, usually establishes the basic mold construction. A major dimension is selected as the parting plane with core slides pulling out as required to form the necessary undercut portions of the casting. The configuration determines whether side or center gating can be employed and therefore establishes the maximum distance that the hot metal will have to flow.

Center gating has the advantages of a minimum flow distance with relatively simple venting provisions. It has the disadvantages of high local heat concentration coupled with more difficult problems of molten metal flow control and inflexibility with regard to multiple-cavity work.

Flow Distance—One can express the flow distance as a function of the cast wall thickness to arrive at a variable useful to the practical diecaster. It has been shown that a part with a "100 T" ratio (obtained

TABLE III—Properties of Mg, Al, and Zn Diecasting Alloys[1]

ASTM alloy	AZ91B	SC84	S12	AC41B
Alloy base	Mg	Al	Al	Zn
Tensile strength, psi	34,000	46,000	43,000	47,600 (70°F)
Yield strength, psi	23,000	23,000	21,000	.....
Per cent elongation in 2 in.	3	2.5	2.5	.....
Density, lb/cu in.	0.066	0.098	0.096	0.24
Density, lb/cu ft	110	170	166	418
Weight ratio	1	1.54	1.51	3.8
Liquidus, °F	1105	1100	1080	720
Solidus, °F	875	970	1065	717[7]
Heat of fusion, Btu/lb	159.8	175	175	43[7]
Mean specific heat, Btu/lb/°F	0.33	0.35	0.35	0.10
Thermal conductivity, Btu/hr/sq ft/°F/ft	46	55.5	70	63
Mean thermal diffusivity	1.3	1.01	1.2	1.5
Casting range, °F ..... from	1180	1175	1175	740
to	1220	1300	1300	800

by dividing the length of flow in inches by the wall thickness in inches) readily can be made as a commercial magnesium diecasting. This means that the part would have a maximum flow distance from the gate of 10 in. with a wall thickness of 0.100 in. Production conditions for a part with a "200 T" ratio are much more critical and represent the current limitation of the cold chamber diecasting process for magnesium.

Casting wall thickness is a most important variable with respect to gating and the common range is from 0.080 to 0.250 in. Probably a good average wall for decorative applications would be 0.100 in. while structural castings might run closer to 0.200 in. Both cases should be considered in any discussion of gating.

Theoretically the solidification rate is proportional to the square of the wall thickness, leading to the conclusion that the 0.200 in. wall casting will take four times as long to set up as the part with a 0.100 in. wall. This result seldom is observed in practice because of premature freezing of the gate.

In other words, the shrinkage is fed until the gate freezes, after which shrinkage voids form in the casting. The net result is that superior properties in the heavier walled casting still may depend upon a relatively fast fill. This technique increases the problems of air entrapment putting a real premium on die design skills. In this case an alternative choice is to use injection pressures above the normal operating range of 5000 to 10,000 psi.

Remote heavy sections may cause trouble in magnesium diecastings unless they can be fed and vented properly. In some cases an auxiliary runner and gate can be used to accomplish better feeding. However, it is more common to resort to the use of flat or vertical ribs.

Venting can be improved by adding ejector pins on the movable die cavity or by adding fixed cores with slightly flattened sides on the stationary die cavity. Vents on the stationary die never are completely satisfactory because one never knows when they will be plugged to cause scrap castings.

Injection Pressures—An injection pressure of 7500 psi on the molten metal generally is adequate for commercial quality diecastings in AZ91 alloy. If pressures above 10,000 psi are found necessary, something usually is wrong with the casting technique. With aluminum alloys, much higher pressures sometimes are obtained by hydraulic intensifiers which multiply the effective oil pressure to squeeze the metal at the end of the shot. One often can observe considerable travel of the injection piston as the alloy freezes.

These intensification systems are not effective with large, average, or thin-walled magnesium parts because the solidification time interval is shorter than the action time of the intensifier. Some benefit can be realized from such a system when the part to be cast is designed with a heavy wall and limited projected area. Even then, however, very little movement of the injection plunger occurs during the squeeze as described for the aluminum alloys.

An investigation currently is being conducted to determine the effectiveness of intensifier systems which will multiply the pressure in a few hundredths of a second.

The effect of injection pressure on the molten metal passing through the restricted gate can be predicted theoretically from Bernoulli's Theorem from which one can derive the formula:

$$V_{gate} = \sqrt{\frac{2gP}{\rho}}$$

where: V_{gate} = liquid velocity in the gate, fps
g = 32.2 fps per sec
P = pressure on the metal, psf
ρ = specific weight of the metal, lb per cu ft

The gate orifice creates a flow pattern in the molten metal passing through it. The pattern depends upon the shape of the orifice. A poorly-shaped gate orifice will offer maximum resistance causing the fluid to form a funnel-shaped flow tube with a greatly reduced cross section.

Metal Velocity Calculation—The metal velocity at the vena contracta (minimum cross section) is the value shown in Table V. These velocity figures seldom are used in shop calculations because the orifice characteristics are not known. It is much simpler to assume that the gate runs 100 per cent full and calculate what one might call an apparent velocity, using the equation of continuity:

$$Q = VA$$

where: Q = quantity of metal flowing per unit time
V = apparent velocity of metal flow
A = cross-sectional area of gate

This approach leads to velocity values below those of Table V, but

TABLE IV—Heat Released to Casting Dies[8]

ASTM alloy	AZ91B	SC84	S12	AC41B
Alloy base	Mg	Al	Al	Zn
Assumed mean casting temp, °F	1200	1200	1200	800
Solidus temp, °F	875	970	1065	717
Ejection temp, °F	775	870	900	400
Δt temperature change, °F	425	330	300	400
Mean specific heat, Btu/lb/°F	0.33	0.35	0.35	0.10
Sensible heat release, Btu/lb	140	118	105	40
Solidification heat, Btu/lb	159.8	175	175	43
Total heat release, Btu/lb	299.8	293	280	83
Mean density, psi	0.066	0.098	0.096	0.24
Volume heat release, Btu/cu in.	19.7	28.7	27.0	20.0

the results are much more readily applied to the everyday problems of diecasting. Magnesium AZ91 alloy castings generally are filled with metal having apparent velocities in the range from 100 to 250 fps.

The dies for most commercial castings could be designed for a velocity of 150 fps. Gates cut to provide that velocity could be enlarged, if necessary, without reducing the velocity below the minimum of 100 fps found to be necessary. A nomograph has been constructed to reduce the time required to make the necessary calculations, see Fig. 1. If the casting weight, W, injection piston diameter, D, and injection piston velocity, Vp, are known, the fill time and gate velocity can be determined.

Speed of the injection piston has been measured in many ways. The usual method is to use accurately spaced contacts or microswitches connected electrically to a timer which records the time interval over the measured distance. This technique seems to work quite well, provided that the measured interval is selected so that it does not include much of the acceleration at the start or deceleration at the end of the stroke. For injection speeds above 600 fpm, high speed movies or some more elaborate electrical system may have to be used.

The nomograph in Fig. 1 was constructed to solve the following equations:

$$Q = AgVg,\ Q = \frac{\pi D^2 Vp}{4}\ \&\ Q = \frac{W}{\theta}$$

where: Q = quantity injection rate, cu in. per sec
Ag = gate area, sq in.
Vg = gate velocity, fps
D = metal plunger diameter, in.
Vp = metal plunger velocity, fpm
W = metal through the gate to fill the casting, lb or cu in.
θ = fill time, sec.

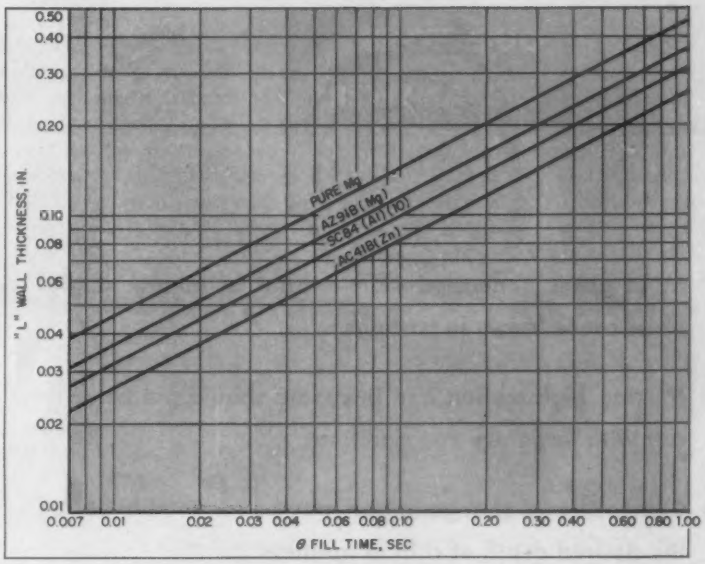

Fig. 2—Graph shows recommended cavity fill times to make good quality diecastings of various wall thicknesses from pure magnesium and three commonly used diecasting alloys

The nomograph saves a great deal of time when one is in the process of deciding how to run a particular casting. For example, in the case shown, the diecaster knew that he was going to use a 3-in.-diam metal plunger and that he could attain a speed of 370 fpm during injection. This fixed the quantity injection rate at 520 cu in. per sec.

Since the casting weighed 3 lb, the fill time was 0.09 sec. With a gate area of 0.74 sq in., the velocity through the gate would be 60 fps—low for good commercial castings. Better practice in this case would be to reduce the gate area to get the gate velocity up to at least 100 fps as recommended previously. Various conditions can be explored in this manner on paper before the die ever reaches the press, saving expensive tryout time on the floor.

Fill time can be defined as the time interval between the first entrance of molten metal into the gate and the complete filling of the mold cavities. For the general run of commercial diecastings, the minimum allowable fill time ranges between 0.01 and 0.06 sec. However, for excellent surface finish, minimum fill times of 0.04 sec have been found necessary. Such values are close to the recommended curve for filling pure Mg diecastings as shown in Fig. 2.

Fig. 2 is a graphical plot of the minimum fill times as a function of wall thickness required for various common alloys. It should be noted that a high quality level is associated with these values. Similar values are used for hardware finish zinc alloy diecastings.

(To Be Concluded)

TABLE V—Theoretical Gate Velocity

Metal Pressure psi	Metal Pressure psf	$\sqrt{P}$	$8\sqrt{P}$	AZ91	SC84	AC41
1,500	216,000	465	3,720	357	286	182
2,000	288,000	536	4,290	411	330	210
3,000	432,000	658	5,270	506	406	258
4,000	576,000	760	6,080	583	468	298
5,000	720,000	848	6,800	650	523	333
6,000	864,000	930	7,440	713	573	365
10,000	1,440,000	1,200	9,600	920	738	470
20,000	2,880,000	1,700	13,600	1,305	1,045	667
30,000	4,320,000	2,080	16,700	1,600	1,285	820

ρ_{Mg} = 109 lb per cu ft (AZ91 alloy), $\sqrt{\rho_{Mg}} = 10.42$
ρ_{Al} = 169 lb per cu ft (SC84 alloy), $\sqrt{\rho_{Al}} = 13$
ρ_{Zn} = 415 lb per cu ft (AC41 alloy), $\sqrt{\rho_{Zn}} = 20.4$

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QUESTIONS and ANSWERS

- **Mold gases generated at re-entrant or interior angles often cause blows in castings**
- **Making high carbon iron in cupola should not be difficult with large pig iron additions**
- **Compositional change in iron may be required to obtain the desired depth of chill in trunnion**
- **Two procedures are possible to aid in overcoming a porous condition on brake drum working surface**

Holes Caused by Mold Gases

We are sending for examination a piece of a spoke from a cast iron pulley which shows numerous gas holes at the juncture with the rim and the hub. As you can see, the holes appear on the cope and drag sides, and they also extend to some extent into the rim and the hub of the casting.

The holes are caused by gas, and probably result from a combination of factors rather than a single one. Where the spoke joins the rim and the hub to form a re-entrant angle, mold gases are generated and move in different directions. Gases generated on the rim and the hub move perpendicular to those sections or horizontally, while the gases formed at the surface of the spoke move vertically.

Roughly twice as much gas is generated by the combination than would be the case with only one surface, and to make it worse the two streams of gas tend to impinge or join together. Unless they can escape freely, they kick or strike back into the casting.

Cause may be due to hard ramming in the area or to the moisture being a little too high, or a combination of those conditions. Possibly the sand is on the weak side and the molders either ram hard or add moisture to prevent drop outs, stickdowns, or broken edges. A temporary measure would be to use the vent wire freely in the affected areas.

Discusses Melting in Cupola

In operating a cold-blast, acid-lined cupola, we wish to obtain an iron containing 3.85 per cent TC, 2.35 per cent Si, 0.50 per cent Mn, 0.30 per cent P, and 0.05 per cent S. Assuming that the foundry return will vary from 5 to 8 per cent and the melting rate 3 tons per hour, can you tell us the analysis of the pig iron to be added, the estimated coke consumption, melting 15 tons per day, and if the process is feasible?

On the other hand, we have a 10-ton electrically heated receiver which might be used if the cupola is unable to supply such high-carbon iron. In that case what would be the required analysis of the pig iron, estimated coke consumption, and necessary additions in the receiver?

From the information you give on the low quantity of foundry returns, and the high total carbon requirement for the iron, we assume that it is to be employed in the production of ingot molds. The composition you indicate has a rather high carbon equivalent (4.73), and we believe better results will be obtained by reducing the silicon content to bring the carbon equivalent to around the 4.3 eutectic value.

Nicholas, for example, points out that the compositions employed by British ingot mold makers is within the range of 3.6 to 3.9 per cent TC, 0.8 to 2.0 per cent Si, 0.7 to 1.2 per cent Mn, 0.08 per cent max. S, 0.10 per cent max. P, and a carbon equivalent of 4.1 to 4.5. Kattus refers to an ingot mold composition in this country as containing 3.84 per cent TC, 1.33 per cent Si, 1.11 per cent Mn, 0.051 per cent S, and 0.20 per cent P, which figures out to a carbon equivalent of 4.35.

But to get back to your specific questions, there is no reason why you cannot produce the composition you mention by cupola melting except that the sulfur probably will be about double due to sulfur pickup from the coke. You should be able to secure the high carbon content since the major portion of the metal charge into the cupola will be pig iron, a high-carbon material.

Considering your figures of melting 15 tons a day, and foundry returns at 8 per cent, you will have 1.2 tons of iron to be remelted each day. With a melting rate of 3 tons an hour, the cupola will be in operation 5 hours a day. Hence each hour one-fifth of the 1.2 tons of returns or 480 lb will be included in the metal charged into the cupola, the remainder (5520 lb) being pig iron. The 3-ton melting rate you mention indicates a small cupola, and it is suggested that the metal charges be limited to 1000 lb.

On that basis each charge will be composed of 80 lb of returns and 920 lb of pig iron. To determine the composition of the pig iron to be used with the foundry returns to result in the desired silicon and manganese contents in the iron over the cupola spout requires some simple calcula-

tions. In order that the 1000 lb iron charge has silicon and manganese contents of 2.35 and 0.50 per cent, respectively, it must contain 23.50 lb Si and 5 lb Mn. In cupola melting, however, there is a loss of about 10 per cent Si and 20 per cent Mn, so the metal charge into the cupola must contain 26.11 lb Si and 6.25 lb Mn.

You know that the 80 lb of foundry returns contains 1.88 lb Si and 0.40 lb Mn, consequently the 920 lb of pig iron has to supply the difference between those values and the amount to be charged into the cupola. In the case of the silicon, the difference is 24.23 lb, and in manganese 5.85 lb. Hence, the pig iron should contain about 2.63 per cent Si and 0.65 per cent Mn.

As to carbon content we would expect the pig iron to contain around 4 per cent. That, with the small amount of foundry returns containing a relatively high carbon content, should result in a carbon content close to the desired figure of 3.85. Some years ago, Levi indicated that an ingoing metal charge into the cupola containing around 4 per cent carbon would result in an iron with about 3.85 per cent carbon.

With reference to coke consumption, we believe that with good quality coke, satisfactory results in melting rate and metal temperature can be secured with an iron-to-coke ratio of 8:1 or 125 lb of coke to 1000 lb of iron. That does not include coke used in the cupola bed. If the quality of the coke is poor, more will have to be used.

Casting Chill Lacks Depth

We are making a chilled cast iron trunnion with an OD of 15 in., an ID of 6 in., and a 5 in. face which we produce with a 6-in. chiller. We have difficulty, however, in getting more than ⅛-in. chill depth and would like to obtain at least ¼ in.

Considering the thickness of the chill you are using, no difficulty should be encountered in obtaining the desired chill, provided the composition of the iron used is suitable for the 4½-in. section involved. For such sections we would expect the silicon to be around 1 per cent.

If the trunnion castings form only a small part of the production, so that you cannot adjust the cupola charges without causing trouble in the other castings produced, you might try the addition of some ferrochromium to the iron poured into the trunnions.

Since we do not know your present silicon content, we can only point out that 1 part by weight of chromium will balance the chill-restraining effect of 1½ parts of silicon.

Another possibility would be to coat the chill with a tellurium-bearing wash, but sometimes that is washed by the metal stream into other parts of the casting where it is not desired.

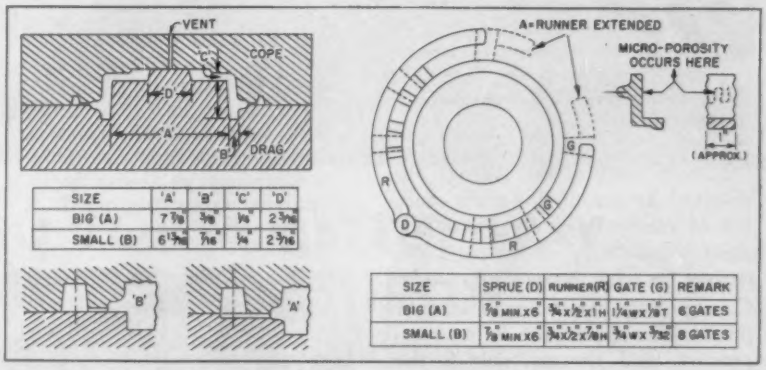
Encounters Porosity in Brake Drums

In our foundry in India we produce gray iron automotive castings such as cylinder blocks and heads, flywheels, inlet and exhaust manifolds, brake drums, and other castings for passenger cars. We are having heavy rejections in brake drums due to microporosity. In the foundry, loss is below 5 per cent, but in the machine shop, the rejection is about 50 per cent. One or two spots of microporosity show up on the braking surface in the final polishing operation. The porosity appears in the form of a few specks at the position shown in the accompanying sketch, but sometimes to a greater extent.

Brake drums are made in synthetic green sand having 4 to 5 per cent moisture, 10 to 12 psi compressive strength, and 60 to 80 permeability. Molds are made on jolt-squeeze pinlift machines using air at 80 psi. Cope flasks are 6 in. high, and drag flasks may be 4 or 6 in. high. Iron shows 3.1 to 3.2 per cent TC, 2 to 2.2 per cent Si, 0.2 to 0.3 per cent P, and over 0.6 per cent Mn. Metal is poured at about 1450° C (2640° F), and pouring time is 6 to 7 seconds. Brinell hardness of the iron is 210 to 240.

We have tried bringing down the carbon equivalent of the iron but the microporosity persists. We have not tried any change in the gating system since we know it is the standard system used for making brake drums. Metal, sand, and molding operations are being controlled.

As the carbon equivalent of gray irons decreases from the 4.3 eutectic value, the tendency toward internal shrinkage increases, and greater difficulty is encountered in gating and risering to obtain sound castings. Although the iron you are using with a carbon equivalent range of 3.83 to 4.03 is not exceedingly low, less graphite precipitation and accompanying volume expansion occur than when the carbon equivalent is close to 4.3. Hence, external feeding through the gating system is essential.



SIZE	'A'	'B'	'C'	'D'
BIG (A)	7 5/8"	3/8"	1/8"	2 3/16"
SMALL (B)	6 15/16"	7/16"	1/4"	2 3/16"

SIZE	SPRUE (D)	RUNNER(R)	GATE (G)	REMARK
BIG (A)	7/8" MIN X 6"	3/4" X 1/2" X 1" H	1 1/4" W X 1/8" T	6 GATES
SMALL (B)	7/8" MIN X 6"	3/4" X 1/2" X 7/8" H	3/4" W X 3/32"	8 GATES

Drawings showing method of molding and gating brake drum castings also present information on dimensions involved

It is our opinion that the difficulty with the brake drums is that the wide, thin gates tend to freeze before the feeding requirement of the heavy rib section is satisfied. Possibly some change in the gating system might remedy the condition. Increasing the thickness of the gates might help, but that would create the problem of breaking into the casting during gate removal. Another procedure would be to reduce the number of gates into the casting.

That would increase the amount of metal flowing through, increasing the temperature of the sand around the gate, and thus reducing the freezing rate.

We believe, however, that your trouble can be overcome by a change in the metal composition which will result in a carbon equivalent of around 4.3. This can be accomplished by adjusting the raw material charge into the cupola so that the total carbon at the spout ranges from 3.40 to 3.50 per cent.

Desires Fine Surface Finish

We have been experimenting recently with permanent molds for cast iron soil pipe fittings, and had some difficulty in obtaining the desired inside finish. We are trying to eliminate any machining or grinding except on the flat mating surfaces of cope and drag. These castings weigh approximately 200 lb and have metal thicknesses from 3 to 6 in. Any suggestions on facing sand, mold wash, etc. to give the desired finish will be appreciated.

Smooth surfaces on castings are obtained by use of fine-grain sand, but of course there are limitations since permeability of the sand decreases as the fineness increases. Consequently the choice of sand in production operations is a compromise, and the selection is the finest grain which will not result in blows. Satisfactory results can be obtained, however, by taking extra steps in the molding procedure such as use of facing sand or mold washes.

Mold washes function primarily by filling up the pores between the sand grains; they also provide additional refractoriness on the mold face. Where carbonaceous materials form the base material, as is common with gray iron molding, the facings also may aid in producing a desirable condition, a reducing atmosphere in the mold cavity.

Mold washes usually are aqueous suspensions, and skin or oven drying is necessary to eliminate excess moisture. Where a volatile carrier such as alcohol is employed, the coating may be ignited or left to air dry.

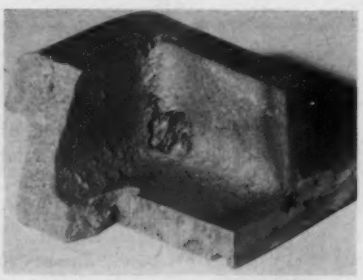
Facing sands in gray iron practice are used mainly to provide better peel or separation of sand from the casting, and/or better surface. In many foundries these results are achieved by mixtures of half old sand and half new sand with addition of a carbonaceous material such as seacoal. If such facing sand does not provide the desired surface finish, the facing is made of sand much finer than that normally employed. The sand may be natural or synthetic molding sand depending on the practice followed. A layer of 1 to 3 in. is riddled onto the pattern, backed with regular foundry sand, and rammed into place.

Other practices, however, have been employed with successful results. One method for heavy gray iron castings reported by Mulligan is a facing sand composed of 100 lb of 125 AFS grain fineness sand, 3 to 5 lb sodium silicate binder, 2 lb pitch or 1 lb graphite for peel, and up to 2 lb western bentonite for green strength. A layer of about 4 in. is applied to the pattern, backed with regular sand, and rammed firmly into place. The mold is not gassed, but is allowed to air dry before being filled with molten metal.

Another suggestion is use of carbon sand as the facing material. That material is mixed with 7 per cent western bentonite, 7 per cent fireclay, and 5 per cent water. For best results the facing must be rammed firmly into place.

Defect in Casting Is Caused by Gas

We are sending for your consideration a section of a small gray iron case which shows porosity on the inside corners. The iron is ordinary gray iron with 2 per cent Cr added in the ladle. The casting with attached gating system is shown in the photographs. There is disagreement on whether the defect is shrinkage or blowholes. What is your opinion?

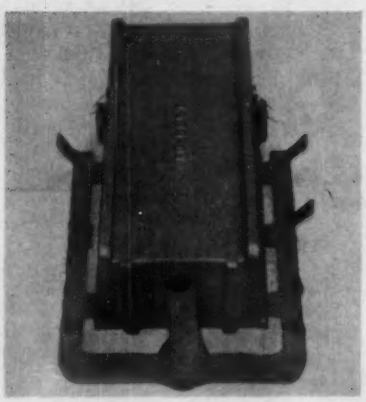


Section of gray iron casting shows the location of defects in corner

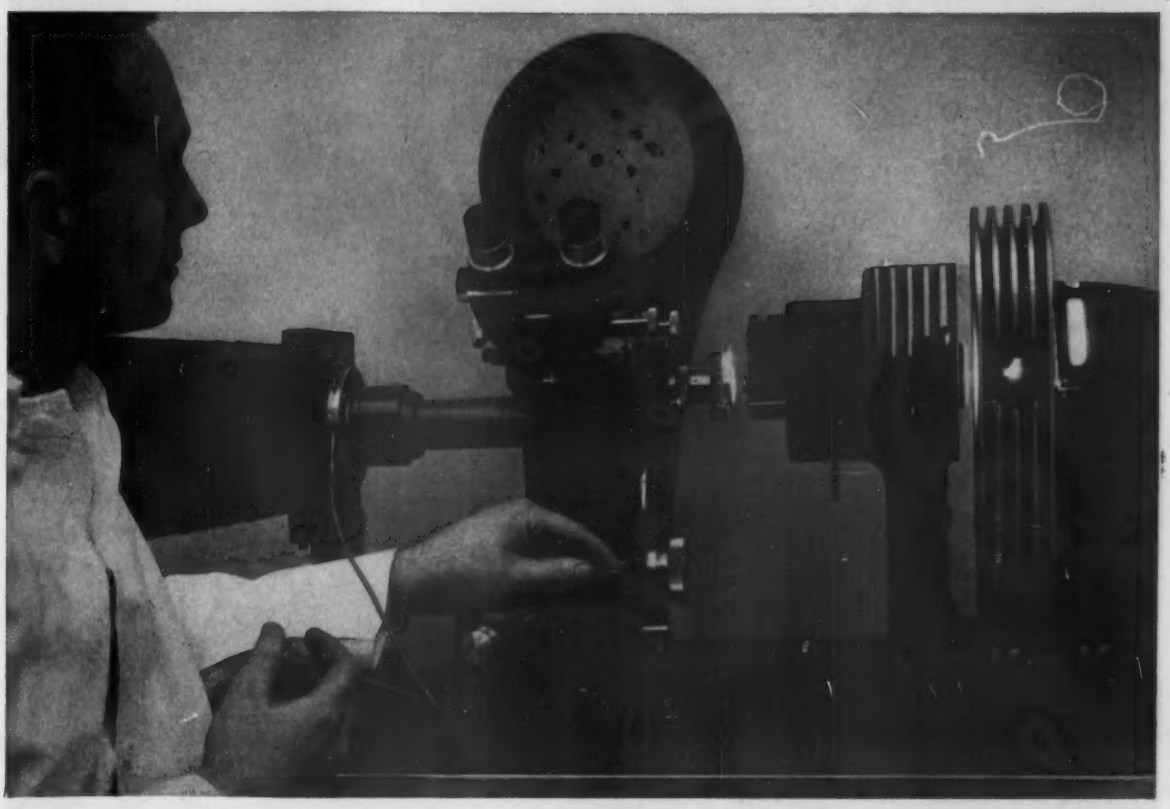
Examination of the defective areas indicates that they are blowholes. The holes on the interior surface have dull blue interiors, showing the presence of oxidizing gases during their formation. Appearance of the hole interiors is that which occurs when a boiling action takes place. Shrinks usually occur midway between the casting walls, but they may be closer to one wall than the other depending upon the freezing rate.

In practically all cases the interiors of shrinks show formation of interdendritic crystals, and the interiors are bright. Occasionally where the shrink is close to the wall, the latter may be pulled in sufficiently to rupture and permit entrance of oxidizing mold gases, discoloring the surface.

It might be pointed out that the defects appear in an area where the sand is surrounded on three sides with molten metal, and unless the sand possesses sufficient permeability, blows are likely to occur. That is because the mold gases generated at the several interfaces move perpendicularly to them, and if they cannot escape readily, they concentrate in a small area, striking back to the mold-metal interface. Also, more mold gases are generated in such areas due to greater heat concentration.



Gating system for casting. Defects occur in corners of ribbed section



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If you are searching for a better way to make ductile iron . . . or for that matter . . . any metal casting . . . and at the same time keep your costs in line, write to Sorbo-Mat Process Engineers for more information. Many major foundries throughout the United States and Canada have solved their casting problems with Sorbo-Mat.

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Controlled Specifications Cast Metals

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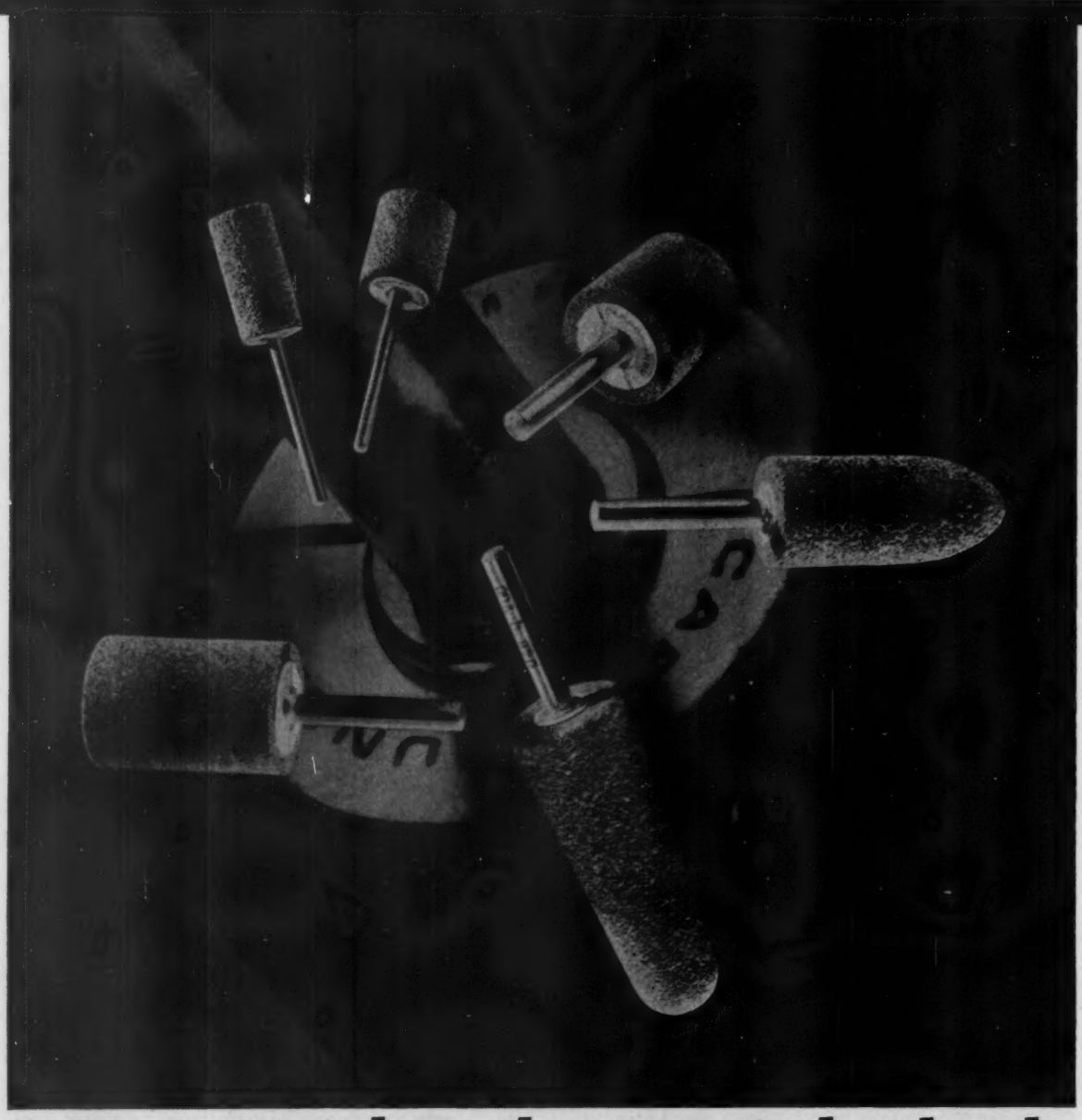
For More Information Circle 613, Page 39

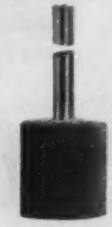


NEW... Metal-Lock Mounted Wheels

... extra strength for trouble-free portable grinding

Mandrel failure, wheel breakage and fly-off is reduced to a minimum with Carborundum's new Metal-Lock Mounted Wheels. With mandrels actually metal-fused to the abrasive, the Metal-Lock Mounted Wheels withstand extreme heat and vibration on the roughest of grinds. The abrasive can be used effectively right down to the mandrel. Clean, even metal mounting also assures precise balance in every wheel. Carborundum's Metal-Lock Wheels are identified by the new red and white blotter... call your Carborundum distributor for a demonstration. Bonded Abrasives Division, Niagara Falls, N. Y. **CARBORUNDUM**

METAL-LOCK MOUNTING. Die-cast metal in molten stage is injected into wheel under pressure, fusing it to the abrasive grain (circle) to produce this new more durable mandrel bond.



TORTURE TEST PROVES STRENGTH. Metal-Lock Mounted Wheels were subjected to a series of torque stress tests in Carborundum Laboratories. In each test, at point of maximum stress, the ¼" stainless steel mandrels snapped off before there was any evidence of yielding between mandrel bond and wheel.

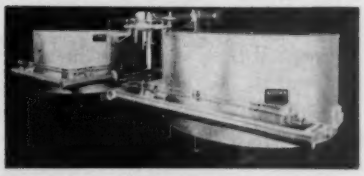
For More Information Circle 614, Page 39

New EQUIPMENT and SUPPLIES

For More Information, Use Reader Service Card—Page 39

POT-TYPE MELTING FURNACES

Series NF pot-type melting furnaces are engineered for melting and holding zinc, aluminum, magnesium, lead, Kirksite, and other nonferrous metals. Low fuel con-



sumption is accomplished with new combustion chamber and flue designs which assure uniform circulation and distribution of heat to the entire pot surface. Special lining reduces heat loss to a minimum. Furnaces can be equipped for gas, oil, or dual fuel operation. A manual, single-valve control is standard, but automatic temperature controls are optional. Furnace sizes and temperature levels are built to customer requirements.—**J. A. Kozma Co.**, 2471 Wyoming Ave., Dearborn, Mich.

For More Details Circle No. 402—Page 39

POLISHING GRINDING UNIT

Polishing and grinding machine is for use in metallurgical and quality control laboratories for preparation of metallographic specimens. It fea-

tures an 80-1200 rpm variable speed control with a semiconductor ½-hp, dc motor which provides constant torque at all loads. Pan, lap, polishing wheel, and cover can be changed quickly as one unit.—**Geoscience Instruments Corp.**, 142 Maiden Lane, New York 38, N. Y.

For More Details Circle No. 403—Page 39

FURNACE POWER AMPLIFIER

Proportional power magnetic amplifier coupled with a standard saturable core reactor can control the temperature of an electric furnace with a high degree of accuracy. The magnetic amplifier operates from a 110-v, single phase, 60-cycle line with a 0-5 ma input from any automatic controller installation. Output from the magnetic amplifier normally can vary from 0 to 85 v dc.

A linear change in system input from the controller produces a percentage change in process power as the amplifier feeds its output into the control winding of a standard saturable reactor. Amplifier consists of five separately removable circuit panels installed in a heavy-gage steel box with provisions for either flush or surface mounting.—**Hevi-Duty Electric Co.**, 304 Hart St., Watertown, Wis.

For More Details Circle No. 404—Page 39

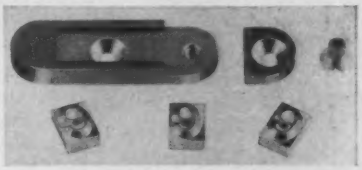
ALUMINA RAMMING MIXES

Two new, high-alumina ramming mixes contain the minimum amount of water needed to give ramming workability and are shipped in 200-lb drums for additional storage life. Typical applications for Hi-Ram 70, which contains 70 per cent alumina, include burner blocks, burner tunnels and firing cones, crucible furnace linings, reverberatory furnaces, and ladles for gray and malleable iron. Hi-Ram 90 is suited for furnaces which are operated under high temperatures and in crucible covers, ladles, and soaking pits.—**Kaiser Refractories & Chemicals Div., Kaiser Aluminum & Chemical Corp.**, Kaiser Center, 300 Lakeside Drive, Oakland 12, Calif.

For More Details Circle No. 405—Page 39

REUSABLE PATTERN LETTERS

Reusable pattern letters of brass or steel are mounted in a brass holder which is recessed in the pattern. As shown in the illustration, the letters slide into the ways of



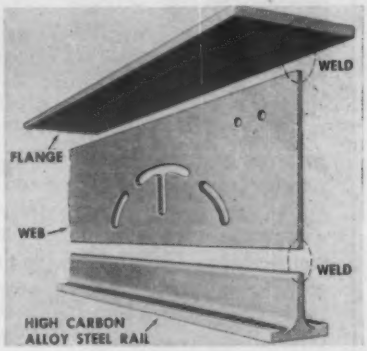
the holder and are held in place by an end plate. Holders are available for any size or number of letters or monograms.—**Freeman Supply Co.**, 1152 E. Broadway, Toledo 5, Ohio.

For More Details Circle No. 406—Page 39

OVERHEAD CRANE TRACK

Tarca Track is a heavy-duty track for overhead material handling equipment such as cranes, carriers, and trolleys. Designed to provide maximum strength with minimum weight, the track is a compound section consisting of a steel flange and web and a specially rolled, alloy steel rail, all continuously welded as illustrated. The parts are proportioned to produce a balanced design for loads under all conditions.

The raised tread or running sur-



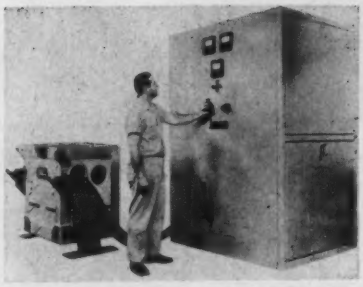
face is smooth and becomes highly polished in service, assuring continued easy use. Track is fabricat-

ed in standard sizes ranging from 8 to 20 in. deep and in lengths up to 60 ft. Special sizes and curved tracks are available. — **Cleveland Tramrail Div., Cleveland Crane & Engineering Co.**, Wickliffe, Ohio.

For More Details Circle No. 407—Page 39

INDUCTION POWER SOURCE

New induction power source for melting utilizes a static frequency-multiplying circuit that converts a balanced 3-phase, 60-cycle power input to a 180-cycle output which provides stronger stirring forces than developed by comparable high-frequency induction melting furnaces. Unit has special transformers, in place of motor-generator sets, which cannot be damaged by overloads. Output can be varied to meet changing load requirements. Moderate output (up to 750 v) eliminates arcing and insulation problems when the unit is used for melting. Units are available with



output capacities from 125 kw to above 700 kw, and with furnaces for almost any melting requirement. —**Inductotherm Corp.**, 10 Indel Ave., Rancocas, N. J.

For More Details Circle No. 408—Page 39

EPOXY BIN COATING

Epoxy covering is for coating bins, hoppers, and other material handling equipment. The material forms a hard, glass-like coating which prevents sticking and reduces wear by granular materials. It can be brushed, rolled, or sprayed and requires a minimum of drying time. Coverage depends on degree of surface roughness, but 1 gal generally will coat 400 to 500 sq ft of area.—**Frederic B. Stevens Inc.**, 1800 18th St., Detroit 16, Mich.

For More Details Circle No. 409—Page 39

RUBBER REPAIR COMPOUNDS

Rubber repair compounds consist of two liquids which are mixed together and cured at room temperature to form a strong, tough, resilient product. They are nonshrinking, and thick sections can be poured or cast at one time. Devcon R-A is a putty-like substance for applications where the material mustn't run or sag while it cures. Devcon R-B is a liquid which can be poured. Both have high tensile strength, tear and abrasion resistance, and good adhesion to many materials. Suggested applications include linings for machinery subject to severe abrasion, gaskets, repairing rubber belting or hoses, and vibration damping mounting pads. —**Devcon Corp.**, Danvers, Mass.

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WET BLAST ABRASIVES

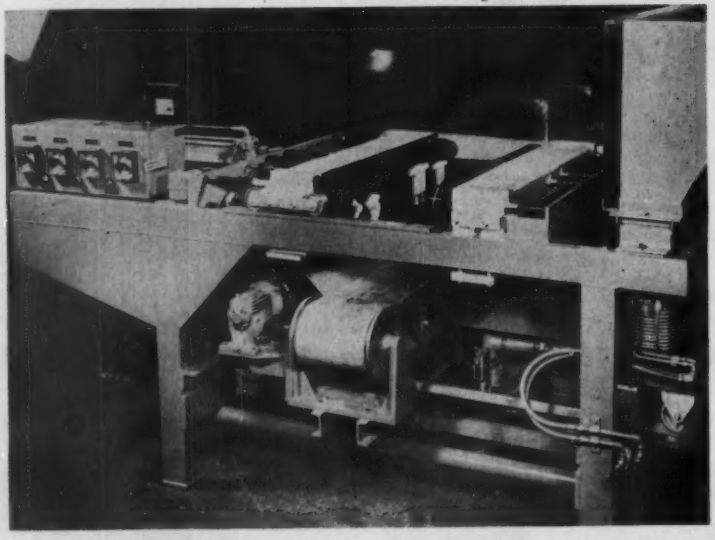
Wet blast abrasives include straight or inhibited types for abrasive blasting, scale removal, deburring, honing, lapping, blending, and polishing. The inhibited abrasives feature dispersion-aiding and oxidation-retarding agents. The media is available in coarse to flour sizes in materials such as aluminum oxide, Novaculite, various ores, and natural and synthetic grain, grit, and shot. It is packaged in 50-lb containers.—**Hydra & Power Blast Mfg. Div., Automation Services Inc.**, Detroit 38, Mich.

For More Details Circle No. 411—Page 39

ALUMINUM PLATING PROCESS

Process for plating on aluminum uses a dilute zincate solution known as Alumon D. The bath is made up at a concentration of 1 lb of salts per gallon of solvent. It is said to be easy to make up; to be freer rinsing; to penetrate more readily into grooves, blind holes, and screw threads; to reduce dragout; and to minimize carryover of zincate into subsequent plating baths. After a part has been cleaned and acid dipped, it is immersed in this bath for 15 sec to 2 min (at room

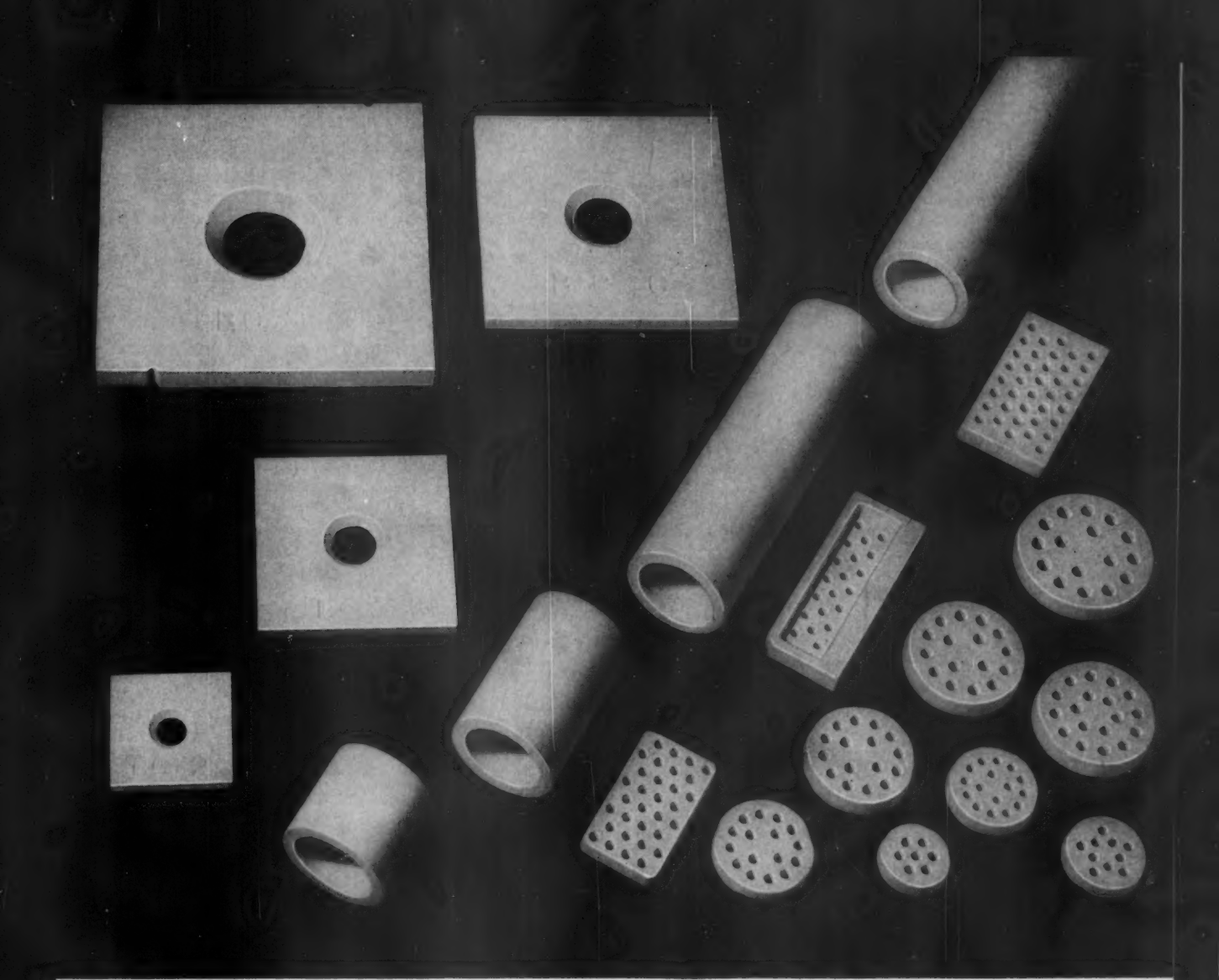
New Shell Coreblower Is Fully Automatic



Model SCB-8 automatic shell coreblower requires only periodic spraying of coreboxes and inspection of cores. A built-in conveyor moves ejected cores into a container or onto a conveyor for transfer to the molding line or to core storage.

Use of adapter plates enables production of a variety of core sizes on this unit. Cores can be up to 8 in. long with any of the following width combinations: Six cores 5 in. wide, three 5-in. and two 7½-in. cores, three 5-in. and one 15-in. cores, four 7½-in. cores, or two 7½-in. and one 15-in. cores. Corebox changes can be accomplished in minutes. The unit is 54 in. wide, 8 ft, 10 in. long, and 39 in. high.—**Shell Process Inc.**, Bliss and Parkside, West Springfield, Mass.

For More Details Circle No. 439—Page 39



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There's a good reason why Louthan is making more and more refractories for the foundry field. *Users like them,* like the way they perform on the job, like the cost reductions they make possible.

Louthan Strainer Cores are now available in more sizes and shapes—and for *steel, iron, brass* and *bronze* castings. All provide an accurate choke for positive control of metal flow, eliminate slag and oxide inclusions.

Louthan Breaker Cores facilitate rapid removal of the riser with subsequent labor savings. There is no core gas. You get cleaner castings. Available for all riser diameters from 2" to 12", and for use with *any metal casting* risering from a flat surface.

Louthan Gate Tiles prevent erosion of the gates in steel castings. They safely withstand high temperatures, will not react with the molten metal. All popular diameters and lengths can be furnished, also elbows and tees to match.

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For More Information Circle 615, Page 39

temp) to receive a thin, dense, uniform zinc film. With this film, the part can be electroplated with copper, nickel, or other deposits. The material is available as a powder or as a liquid concentrate which can be used interchangeably.—**Enthone Inc.**, 442 Elm St., New Haven 8, Conn.

For More Details Circle No. 412—Page 39

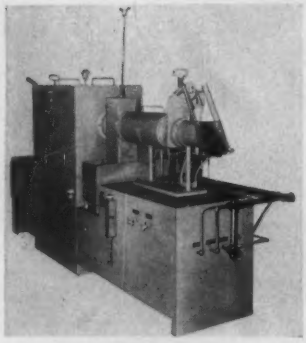
GRINDING WHEELS

Aluminum oxide grinding wheel line is designed to be used for heavy feeds on a variety of materials from high-speed steel to low-carbon steel. Each wheel is said to grind coolly, give fast cutting action, and hold form well.—**Macklin Co.**, Jackson, Mich.

For More Details Circle No. 413—Page 39

HEAT TREAT MUFFLE FURNACE

Muffle furnace for heat treating features a chute between the heat chamber and the cooling jacket which permits either an oil quench or atmosphere cooling. The furnace has a 6-in. ID Inconel muffle, a 20-in. long heat chamber, and a 20-in. long water-jacketed cooling

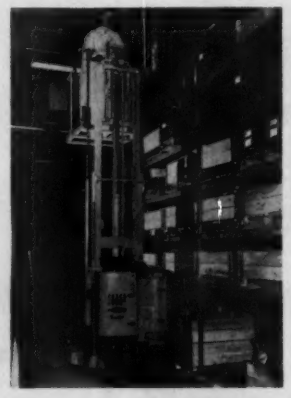


chamber. It provides a maximum heating temperature of 2000° F. Automatic flame curtains at the charging door and discharge door prevent infiltration of air into the muffle. The unit is complete with atmosphere flowmeter, piping, and valves.—**Lindberg Engineering Co.**, 2450 W. Hubbard St., Chicago 12, Ill.

For More Details Circle No. 414—Page 39

TRUCK ELEVATOR CARRIAGE

Hy-Drive elevating carriage on company's 4000-lb capacity narrow aisle electric truck permits order selection or maintenance operations in high areas. A second set of controls on the elevating carriage allows the driver to leave his operating station, step onto the platform, and elevate himself to any height necessary. If he wishes to move the truck while it is elevated, power steering enables him to do so. Built-in safety controls govern travel speed and limit height from which the elevating unit can be operated. A dead-man pedal applies brakes and breaks all electrical circuits when the operator leaves the normal steering position. When the platform controls are not in use,



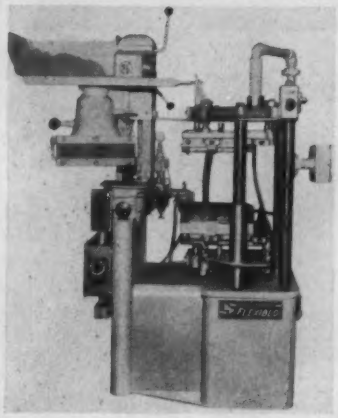
the truck can be used in normal pallet handling operations.—**Raymond Corp.**, 65-189 Madison St., Greene, N. Y.

For More Details Circle No. 415—Page 39

Hot Box Coreblower Features Short Cycle

Model CB-8-SB hot box coreblower is gas-fired and utilizes a side blow to provide a fast, full pressure blow for intricate and complex work in a range of coreboxes up to 15⅜ by 20 in. The unit is easily and quickly adjustable for all coreboxes within the full range of the unit, and no special rigging is required for the majority of boxes. Existing metal coreboxes can be used.

Semiautomatic in operation, the coreblower starts its cycle when the operator pushes a button to clamp the corebox. He then swings the blow plate into position against the corebox and pushes a second button which pneumatically clamps the blow plate to the corebox and actuates the quick-acting blow valve and cure timer. At the end of the predetermined cure time, the corebox is opened automatically and the core is withdrawn, ready for immediate use.



One operator easily can handle two machines. Cycle time is only 7 sec (for clamp, blow, and automatic strip) plus cure time, which varies depending on core section.—**Beardsley & Piper**, division of Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 38, Ill.

For More Details Circle No. 440—Page 39

PORTABLE MAGNETIC TESTER

Portable magnetic particle testing unit produces 1000 amp of ac or half-wave dc to detect surface and subsurface flaws in ferrous materials. Unit can be used with prods or coils for maximum flexibility. Prods can be fastened to a holder for one-hand operation or can be used separately. Tester is fan-cooled and offers five-place ampere selector and safety limit switches. Its dry-type silicon rectifiers are housed in aluminum for lower weight and temperatures.—**Picker X-Ray Corp.**, 25 S. Broadway, White Plains, N. Y.

For More Details Circle No. 416—Page 39

MANGANESE-ALUMINUM ALLOY

Manganese-aluminum alloys for use in steelmaking are made from high-purity electrolytic manganese and primary aluminum. Three standard compositions now available are 60 per cent manganese and 40 per cent aluminum, 65/35 per cent, and 80/20 per cent. Steels

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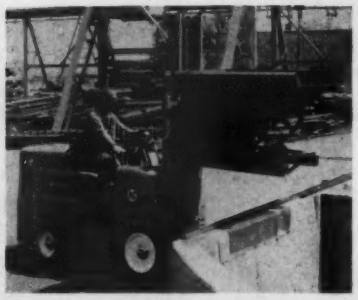
deoxidized with these alloys are reported to show substantial improvements in cleanliness, surface quality, and aluminum recovery. Various sizes of the material can be supplied as well as other compositions. —**Foote Mineral Co.**, 18 W. Chelten Ave., Philadelphia 44, Pa.

For More Details Circle No. 417—Page 39

LIFT TRUCKS

Seven new lift trucks provide capacities from 6000 to 10,000 lb and include special purpose models with 8½-in. ground clearance at the center and 6-in. clearance under the mast to permit travel over uneven surfaces. Trucks are powered by six-cylinder gasoline engines of 77 hp. Diesel and LP gas engines also are available. Masts have piston-type lift cylinders and alloy steel forks. Standard transmission is constant-mesh type, providing two forward and two reverse speeds; an optional unit is a torque converter drive. Hydraulic system features high-volume pump, larger capacity



reservoir, and filter. Attachments are offered to adapt the trucks to specialized jobs. — **Allis-Chalmers Mfg. Co., Tractor Group**, Milwaukee, Wis.

For More Details Circle No. 418—Page 39

SHELL CORE RESIN

Phenolic resin BRS-5575 is for cold coating sand for use in shell cores and shell molds. Shells made from sand coated with this material are said to have excellent peel-back resistance in the uncured state. Also, good shell buildup is obtained in molds of deep to medium draw. The resin is recommended for use where short to medium flow and fast curing are required and for applications in which freedom from shell warpage is difficult to achieve.

Typical properties of sand coated with this resin include cold tensile strength of 405 psi for a sample cured two min at 500° F and hot tensile strengths of 100 psi for a 60-sec cure at 450 and 310 psi for a 90-sec cure at the same temperature. Fusion point of the resin is 215° F. — **Union Carbide Plastics Co.**, division of Union Carbide Corp., 270 Park Ave., New York 17, N. Y.

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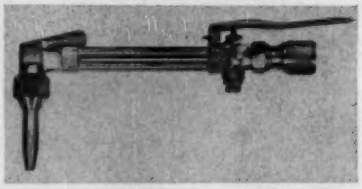
TORCH CUTTING ATTACHMENT

Model 73 medium-pressure cutting attachment will cut up to 6 in. and can be used with company's



No. 63 or 43 heavy-duty welding torches or with No. 18-2 heavy-duty automatic welding torch. Attachment employs the head-mix principle and is virtually impossible to backfire. Double silicone O-ring seals are used for finger-tight union, and the preheat oxygen valve serves as a positive shutoff. Five standard cutting tips can be used as well as special tips for thin plate cutting, gouging, rivet cutting, and rivet washing.—**Harris Calorific Co.**, 5501 Cass Ave., Cleveland 2, Ohio.

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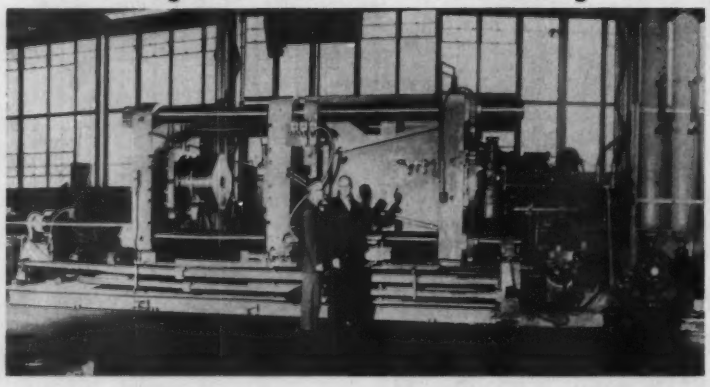
Diecasting Unit Has 1300-Ton Locking Force



Model HP 1300 diecasting machine is rated at 1300 tons of locking force and has been tested to 1600 tons under the standard SDCE strain gage test. Unit has a die separation stroke of 32 in. and will accommodate a die nearly 7½ ft long by 5 ft wide by 5 ft thick. Welded hydraulic system incorporates a 50-hp motor and generates power to cast 60 lb aluminum per cycle under an injection pressure of 12,500 psi with a velocity of 150 ips. Complete cycle requires only 11 sec.

Features include maintenance-free hydraulic system, motorized pushbutton die height mechanism, automatic lubrication, special system for vacuum diecasting, heavy-duty one-piece supporting base, massive toggle linkage unit, hydraulic ejection and core pull mechanism, pushbutton electrical controls, aluminum bronze bearings, alloy steel toggle pins and tie bars, and JIC construction throughout.—**Kux Machine Co.**, 6725 N. Ridge Ave., Chicago 26, Ill.

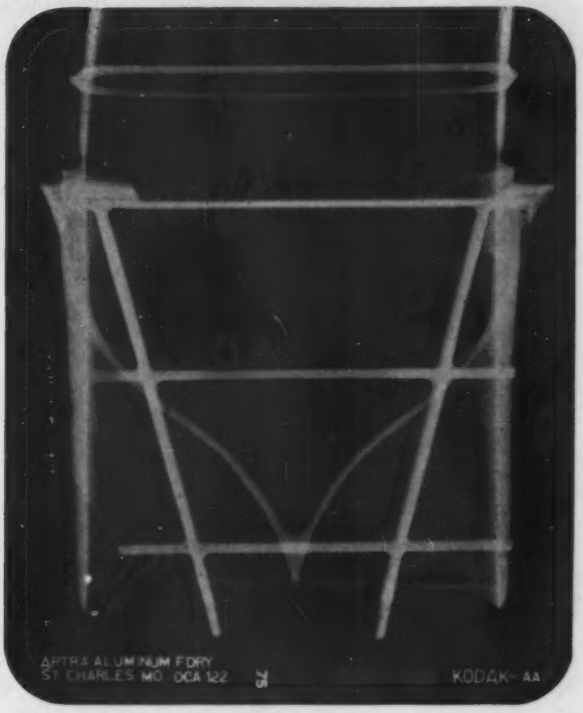
For More Details Circle No. 441—Page 39

PRESSURIZED SPRAYERS

Portable pressurized sprayers are handy for spraying release agents in shell molding operations. Units can be pressurized by compressed air through standard air chucks or by carbon dioxide bombs to dispense light liquids or emulsions in a jet stream or fine mist. Model A has 1-qt capacity and is offered with rigid and flexible nozzle extensions as accessories. Model C has 6-oz capacity, and its accessories include auxiliary hand pump, nozzle extension, and pocket spring clip. Both models feature all-metal construction and are available in various colors for identification of different

To keep cool at a couple of "machs"

Photograph and radiograph of aircraft refrigeration duct cast of magnesium AZ91.



At jet speeds a problem is to keep the pilot cool. Artra Aluminum contributes this magnesium casting for a refrigeration duct, and uses radiography to assure that it is sound and dependable.

Without proper cooling in the cockpit, today's supersonic pilots would cook. Refrigeration is a "must."

Along with other components, Artra Aluminum Foundry of St. Charles, Missouri, provides this AZ91 magnesium casting for the pilot's cooling system. It is ultralight, and ultrastrong. And radiography is used to make certain that there are no flaws.

Artra has earned an outstanding reputation for fine work with materials difficult to cast. And they give full credit to the way radiography helps them to evolve casting methods that greatly reduce rejections and thus makes sure that only quality work is delivered.

Foundries, large and small, find that radiography quickly becomes a valuable asset in their operations. It can work for you, too. You can learn how by getting in touch with an X-ray dealer or writing us to have a Kodak Technical Representative call.

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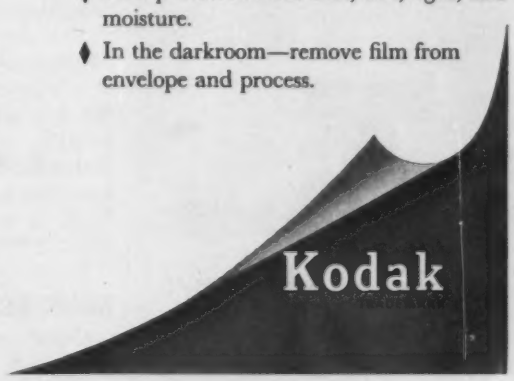
- Just place Ready Pack in position and expose.
- Film protected from dust, dirt, light, and moisture.
- In the darkroom—remove film from envelope and process.



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Special analysis alloy steel . . . electric flash welding . . . controlled heat treating and patented Tayco Hooks make TM Alloy Sling Chains tougher! Link-by-link inspection, scientific testing and signed Test Certificate are additional reasons why TM Alloy Chain is preferred by safety engineers . . . material handling men . . . production superintendents! Call your distributor or write for Bulletin 14-A.

Chain is our specialty—not our sideline!

Taylor Made CHAIN SINCE 1873

S. G. TAYLOR CHAIN CO., Inc.
General Office: Hammond, Indiana
Plants: Hammond, Ind., and Pittsburgh, Pa.

For More Information Circle 618, Page 39

contents.—**Milwaukee Sprayer Mfg. Co.**, 2437 W. Fond du Lac Ave., Milwaukee 6, Wis.

For More Details Circle No. 421—Page 39

HEARING PROTECTOR

Improved hearing protector is claimed to pass wanted sounds into the ear practically undisturbed but to dissipate excessive energy of large-

volume noise so as to render it harmless to human hearing. The portion of the device which enters the ear has been shortened and redesigned to insure perfect fit with greater comfort, regardless of size or shape of ear openings. Company offers trial sets.—**Sigma Engineering Co.**, 1608 Hillhurst Ave., Los Angeles 27, Calif.

For More Details Circle No. 422—Page 39

PHENOLIC CORE BINDERS

New fast-curing modified liquid phenolic resins and accelerators are for use as core binders in high-volume, high-speed foundry operations. The simple wet mix of resin, accelerator, and sand can be prepared in any standard muller. Cure time in a hot corebox may be 15 sec or less at 500° F to produce moisture-resistant cores of good dimensional stability, shelf life, and resistance to overcure.

When cores are removed from the coreboxes, they have hard shells and soft centers. The centers harden as curing continues without additional heat. Water emulsion core washes do not affect these cores. About 2 per cent by weight of binder is required in a sand mix and a mix is usable for 4 hr or more, depending on sand temperature.—**Durez Plastics Div., Hooker Chemical Corp.**, North Tonawanda, N. Y.

For More Details Circle No. 423—Page 39

GRAIN REFINING COMPOUND

Grain refining and degassing compound for aluminum alloys, called 3X-20, is said to be simple and safe to use. Users are reported to achieve better refinement with less scrap and less time than by other methods. Material contains 99.98 per cent degassing and refining ingredients. All that is required to apply the product is a steel rod ½ in. in diam and cut to suitable length.—**Associated Foundry Services Inc.**, P. O. Box 73274, 7600 S. Avalon Blvd., Los Angeles 3, Calif.

For More Details Circle No. 424—Page 39

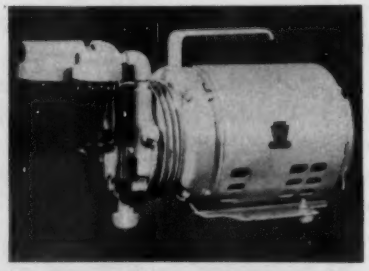
MULLER PADDLES

Muller paddles made from Tufflex are said to outlast paddles made from metal or rubber. It is as resilient as rubber and reportedly will not cut, chip, or crack from contact with metal particles in sand. The material also is being used in other foundry applications, in form of tube and sheet, where high abrasion resistance is required.—**Glenwood Industries**, Box 254, Glenwood, Ill.

For More Details Circle No. 425—Page 39

PORTABLE VACUUM PUMP

Portable vacuum pump is a sliding vane type with maximum vacuum of 27 in. of mercury. It will move up to 1.5 cfm of air with entrained liquids. The entire assembly, in a cast iron housing,

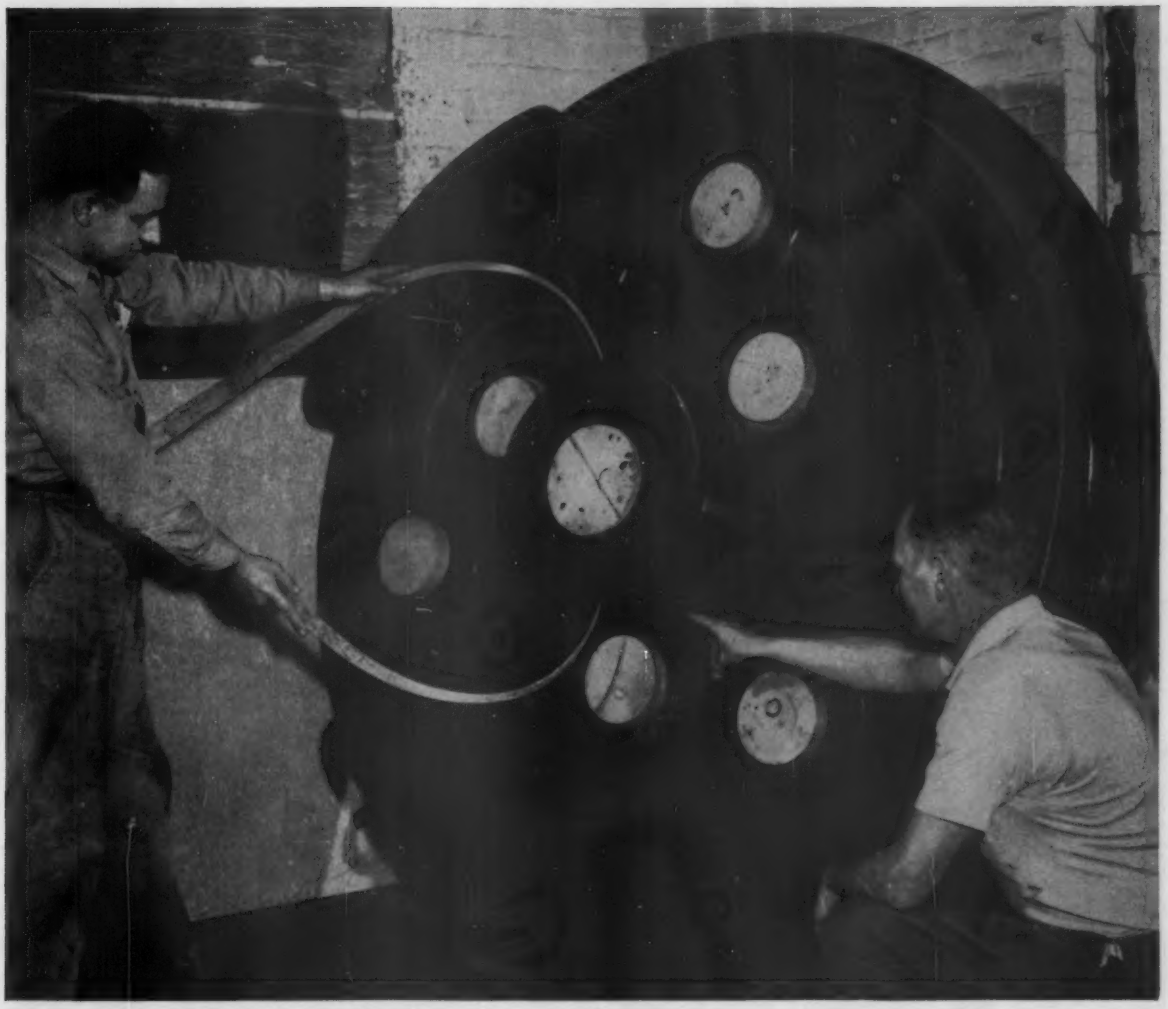


weighs only 25 lb. Standard unit features a 1/6 hp, 115 v, 60 cycle motor of the open drip-proof type. Various special voltages and enclosures also are available. Wick oilers which also serve as intake filters are optional at no extra cost.—**Clark-Cooper Div., Frederic B. Stevens Inc.**, Palmyra, N. J.

For More Details Circle No. 426—Page 39

SPACE HEATERS

Gas-fired space heater heats nonrecirculating make-up air from outside the plant and emits warm air inside. Seven models are available, ranging in air output from 11,000



"This intricate mold produced a casting that passed 100% X-ray tests...thanks to J-M Ris-A-Sleev."

Mickey Fratello, Owner,
Castwell Foundry Company, Inc., Middletown, New York

"By keeping the feed metal molten for 30 minutes, J-M Ris-A-Sleev permitted the thin and heavy walls on a 3,600-pound aluminum casting to be cast to an even density. What's more, we were able to save 1,800 pounds of metal because only 125 pounds were needed for the risers. In addition, Ris-A-Sleev saved us a great deal of time by minimizing the amount of metal that had to be cut and ground off the casting.

"We also find Ris-A-Sleev ideal for *magnesium* castings. We used these J-M risers on an intricate 1,200-pound magnesium casting and got perfect results. As a matter of fact, Ris-A-Sleev is the only riser used in our foundry."

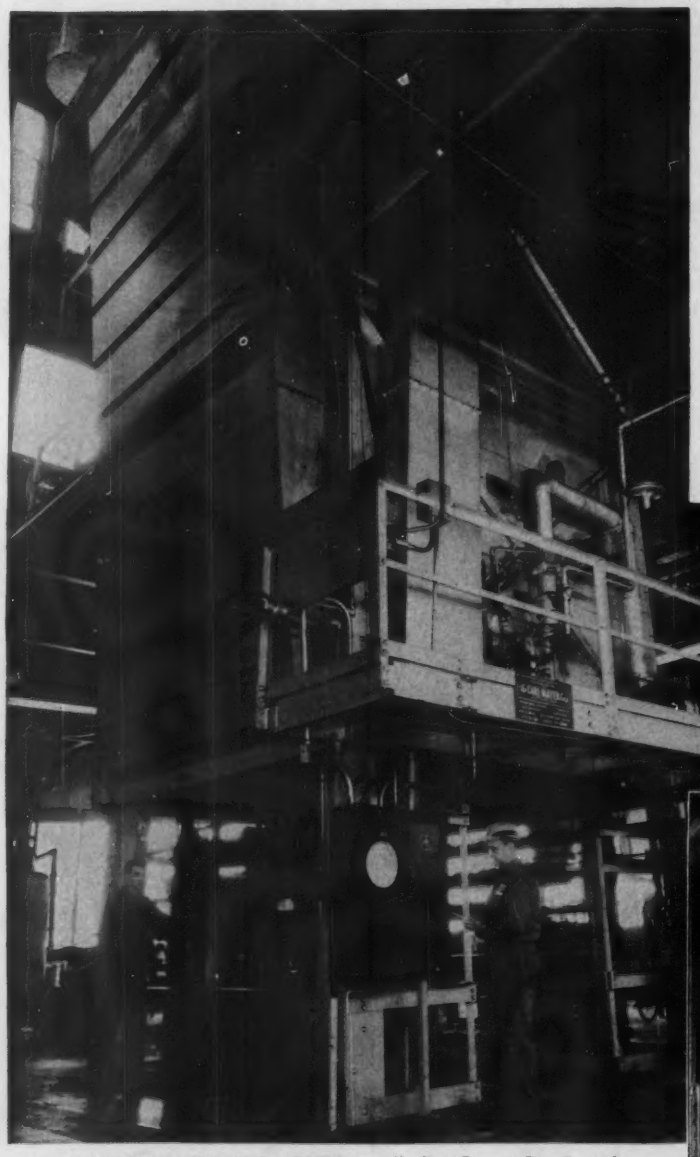
For the full J-M Ris-A-Sleev® story, write to J. B. Jobe, Vice President, Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable: Johnmanvil.

Here you see how J-M Ris-A-Sleev was positioned on this king-size mold to produce a sound casting.

JOHNS-MANVILLE JM

AN INSULATION FOR EVERY COMMERCIAL AND INDUSTRIAL USE

Foundry-Proven Money Makers!
Ovens Designed by carl mayer CORP.



The Carl Mayer Corp. experience in engineering and designing industrial ovens and furnaces is second to none! Carl Mayer ovens incorporate recirculating heating systems with sealed combustion chambers and automatic temperature controls for all fuels. Cores and molds are evenly baked faster, with less fuel consumption.

Many foundries of all sizes have found it pays to install Carl Mayer ovens—Our engineers will be glad to work with you on your oven problems. Write or call now!

Write for Bulletin 53-CM

A NEW VERTICAL CORE OVEN installed at Forest City Foundry, Cleveland, Ohio. Size is 12' 7" x 11' 10" x 57' 8" high above floor. 29 carriers, 3 shelves high; each shelf 30 x 106 inches. Features forced cooling and exhaust system for uniform cooling of cores before unloading.

CAR TYPE MOLD OVEN at American Brake Shoe Co. features under floor chain car puller. Size 10' x 10' x 19' long.

THE carl mayer CORP.

20800 CENTER RIDGE ROAD CLEVELAND 16, OHIO

OTHER PRODUCTS Heat Treating Ovens and Furnaces • Rod Bakers • Welding Rod Ovens • Paint and Ceramic Drying Ovens • Special Processing Equipment and Accessories

to 60,000 cfm and in heat output up to 6,750,000 Btu/hr, with a maximum turndown ratio of 25 to 1. When installed indoors, the intake hood may be attached to ductwork leading outside the building. For outdoor installations, controls and mechanical components are completely enclosed, and the louvered intake hood prevents entry of water. Each heater requires only fuel and electrical connections after positioning.—**Dravo Corp.**, Neville Island, Pittsburgh 25, Pa.

For More Details Circle No. 427—Page 39

GOGGLE CLIPS

Line of goggle clips was developed to prevent goggles from slipping off hard hats and caps whether the goggles are raised or lowered. Clips are easily attached to and removed

from the hats or caps, and the elastic headband can be inserted into the clips without being removed from the goggles.—**American Industrial Safety Equipment Co.**, 3500 Lakeside Ave., Cleveland 14, Ohio.

For More Details Circle No. 428—Page 39

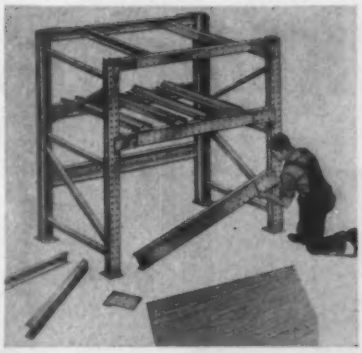
FURNACE ROOF SECTIONS

Monolithic cast roof arches are offered by this company for its Sklenar melting furnaces. Sections are made by pouring castable refractory over wooden forms, resulting in savings in installation time as well as in greatly extended roof life. Design of the sections eliminates protruding or stepped refractory segments.—**U. S. Smelting Furnace Co.**, Belleville, Ill.

For More Details Circle No. 429—Page 39

RACK ASSEMBLIES

Series 4000 Bild-a-Rack comes packaged ready for assembly without special tools or extra equipment. Components are fabricated of galvanized steel channel. Maximum upright capacity for 144 in. is 10,600 lb and beam capacity up to 4200 lb is available for each pair of



shelves to a span of 106 in. All rated capacities are figured with 1.65 safety factor over the yield strength. Multiple or single units, in all popular sizes, are offered.—**Paltier Corp.**, 1701 Kentucky St., Michigan City, Ind.

For More Details Circle No. 430—Page 39

DISPOSABLE SHOP TOWELS

Disposable shop towels are a wood cellulose product designed to replace laundered cloth towels and rags. They are said to be lint free, to have high tensile strength and quick absorbency, and to be reusable. Disposable towels eliminate expense, time, and inconvenience of counting, distributing, sorting, and handling rags and laundered towels. They are shipped in packages of 50 quarter folded towels which unfold to 13 x 15 in. in size. Special metal dispensers are available which can be locked.—**Kimberly-Clark Corp.**, Industrial Products Div., Neenah, Wis.

For More Details Circle No. 431—Page 39

COREBOX CLEANERS

Corcosolv No. 1 is a dry granular material for cleaning cereal and oil binder deposits from coreboxes and vents. It comes in 8-lb containers; when this amount is mixed with warm water, it makes 125 gal of hot or cold cleaner. Corcosolv No. 2 is a liquid cleaner for removing deposits of resin on shell and furan coreboxes, patterns, and equipment. It also can be used as a hand cleaner. If desired, it can be diluted with an equal part of water.—**Martin Engineering Co.**, Neponset, Ill.

For More Details Circle No. 432—Page 39

AUTOMATIC AIR LUBRICATOR

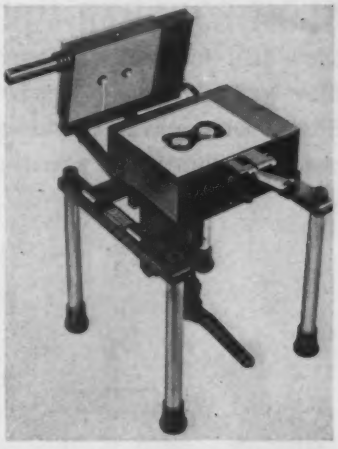
Air lubricator employs a venturi feed that delivers the lubricant to the downstream line in the form of a suspended mist. The exact amount of oil is metered by setting an external adjustment valve. Oil is fed to the air stream in direct proportion to the volume of air consumed, and it does not flow when the equip-

Produces Hot Box Core Tensile Specimens

Hot box tensile specimen curing and stripping accessory, No. 364, is designed to produce tensile specimens 1 in. thick for evaluating mixes used in the hot box process. Unit is provided with an electrically heated box split along the long axis of the tensile specimen.

The tensile specimen is blown through the pivoted upper half and it can be cured for any preselected curing time. Curing temperature is controlled by thermostat. Simple mechanisms are provided to separate the two halves and strip the specimens and a cartridge is used for blowing them.

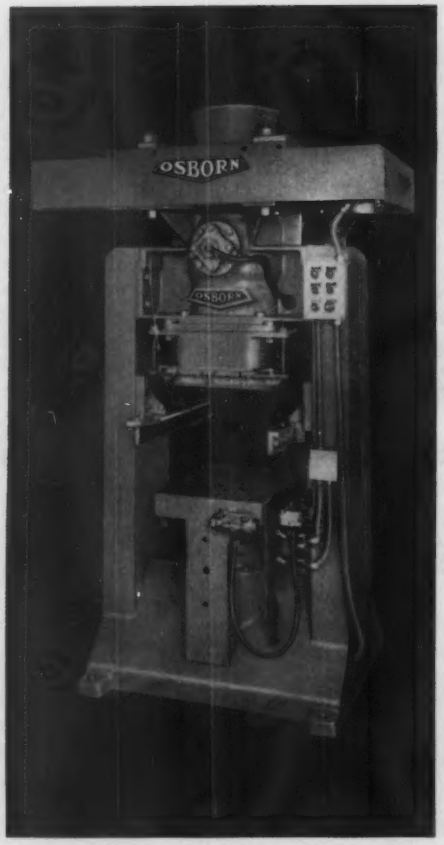
The specimen can be tested when still warm on a sand laboratory sand strength tester, or it can be allowed to stand for any



selected interval to determine gain in tensile strength with time.—**Harry W. Dietert Co.**, 9330 Roselawn Ave., Detroit 4, Mich.

For More Details Circle No. 442—Page 39

THESE NEW OSBORNS KEEP YOU AHEAD TODAY AND TOMORROW!



THIS ADVANCED LINE OF HIGH PRESSURE SQUEEZE MOLDING MACHINES GIVES YOU EXTRA ADAPTABILITY...UNPRECEDENTED DENSITY, UNIFORMITY, HARDNESS AND STABILITY.

And all equipment is carefully engineered for compatibility with the Osborn Automatic Mold Production System. Machines are available with multiple-piston equalizing head or even flexing-equalizing head. These equalizing members mean that the squeeze pressure is applied over the entire mold. Result: even on intricate molds, you get uniform density and high mold hardness of vertical as well as horizontal surfaces. Osborn equipment offers foundrymen a wide choice of versatile, ruggedly-built units . . . designed to meet today's rigid specifications for high quality castings and rapid, low-cost production. Take advantage of Osborn's experience and leadership in foundry mechanization. You can get the job done with an Osborn! Write or call today.

MODEL 19-M BLOW SQUEEZE MOLDER

Blow fill, high pressure squeeze. Blow-type fill reduces sand spillage. Blows exact, controlled volume of sand over entire surface of pattern.

THE OSBORN MANUFACTURING COMPANY

5401 Hamilton Avenue · Cleveland 14, Ohio · ENdicott 1-1900

Molding Machines · Shell Core Machines · Core Blowers · Metal Finishing Machines...and Finishing Methods · Industrial Brushes

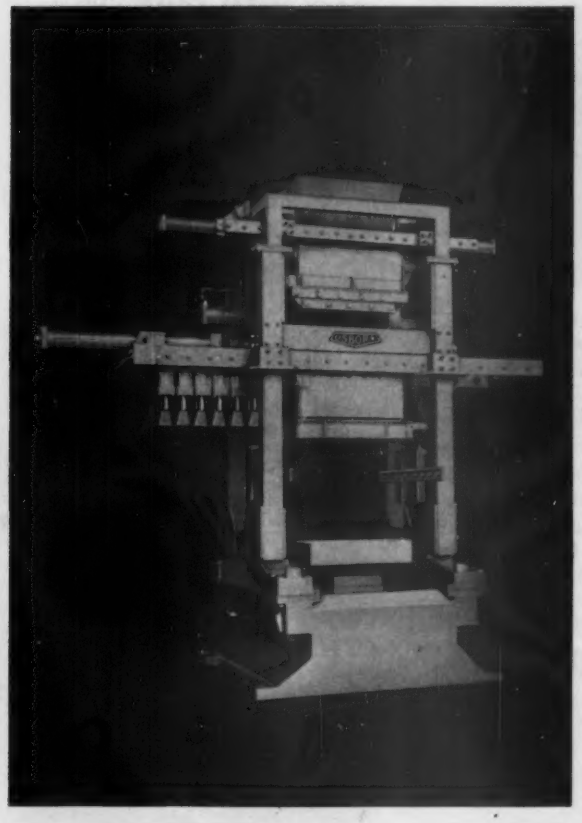
OSBORN®

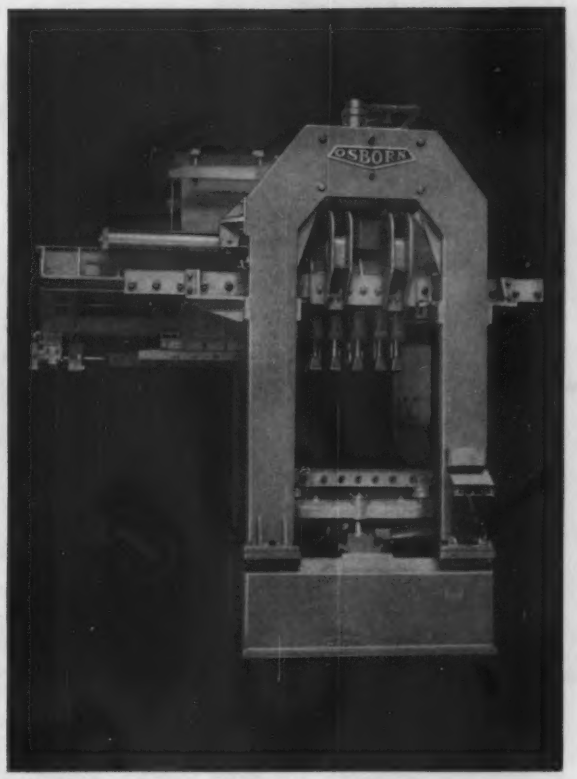
OSBORN AUTOMATIC MOLD PRODUCTION SYSTEM

Is designed for the ultimate in productivity and reliability. Adaptable for a complete range of modern molding demands. Assures efficient, automatic handling of molds and flasks through the entire line of shakeout, separating, molding, coring and closing operations.

MODEL 55
CONTOUR SQUEEZE MOLDER

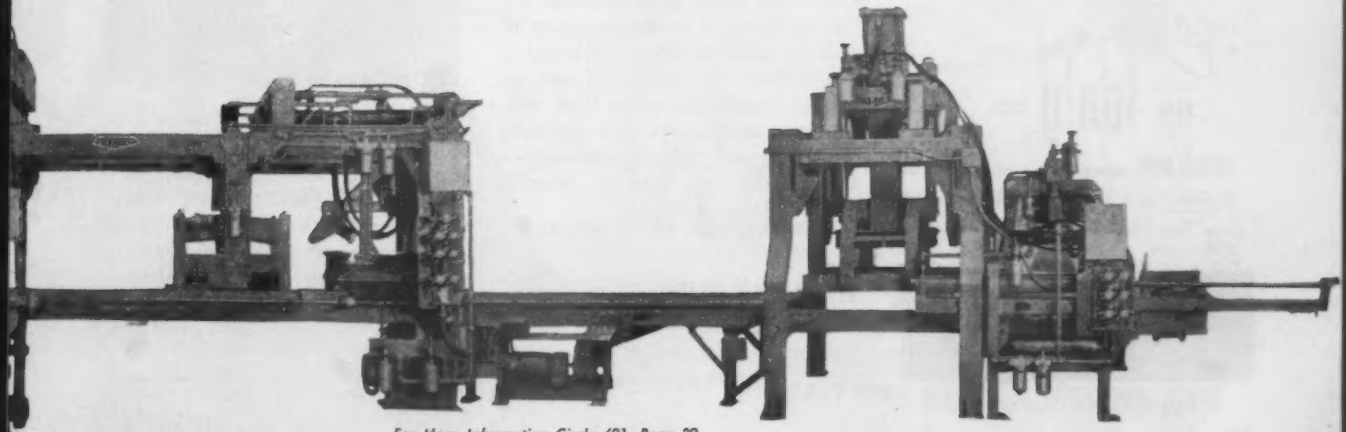
Gravity fill, high pressure equalizing squeeze. Automatic, uniform flask filling. Available with multiple-piston equalizing head (as shown) or flexing squeeze board. May be operated with pattern shuttle device.





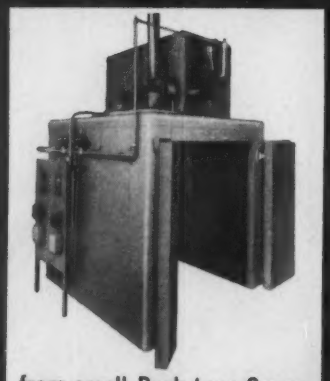
MODEL 1360
JOLT SQUEEZE STRIPPER

Gravity fill, conventional jolt and high pressure overhead equalizing squeeze. Offers complete squeeze board flexibility—available with multiple-piston equalizing head (as shown), flexing head or even rigid biscuit type squeeze board. Also may use pattern shuttle device.

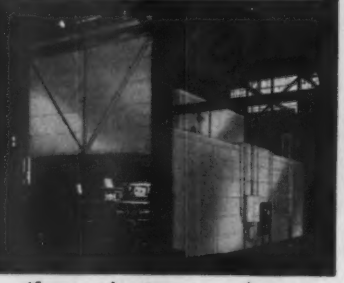


For More Information Circle 621, Page 39

LANLY heat processing equipment for the FOUNDRY INDUSTRY



from small Rack type Ovens to the BIG CAR TYPE OVENS



If a need arises to replace or improve your Foundry Ovens, it is only logical to look to LANLY, recognized authorities in the design and construction of heat processing equipment for more than 22 years.

TODAY may be the opportune time to survey your present facilities and request the counsel of a LANLY representative at no obligation.

THE Lanly CO.

FOUNDRY OVENS 2806 Euclid Ave., Cleveland 15, O.

write for FREE bulletin

Find Your Representative in The Yellow Pages

Atlanta, Georgia Birmingham, Ala.
Boston, Mass. Chicago, Ill. Cleveland, Ohio
Columbus, Ohio Detroit, Mich.
Rochester, N. Y. Pittsburgh, Pa.
San Francisco, Calif. St. Louis, Mo.

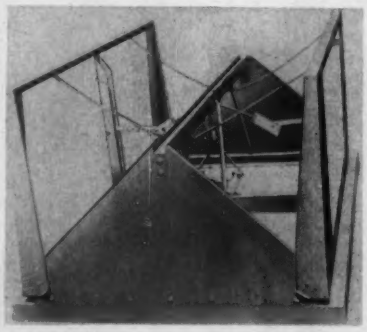
For More Information Circle 622, Page 39

ment is not in operation. A filler valve permits refilling the transparent oil reservoir without shutting off air or stopping operation. Lubricators are available in ¼, ⅜, ½, and ¾-in. NPT sizes.—**Perfecting Service Co.**, 332 Atando Ave., Charlotte 6, N. C.

For More Details Circle No. 433—Page 39

SKYLIGHT VENT UNIT

Skylight vent unit designed to vent heat, smoke, or shock waves through the roof features fiberglass



windows to serve as the skylight. The unit is installed entirely above the roof. It has a quick release chain for manual operation, and handles permit opening from the roof without disturbing the release mechanism. When the dampers open, snubber chains and springs hold them vertical for maximum draft.—**Swartwout Fabricators Inc.**, 100 E. North St., Kokomo, Ind.

For More Details Circle No. 434—Page 39

CORE SAND ADDITIVE

Core sand additive is said to reduce bake time by as much as 60 per cent. It is a furan resin-type binder and replaces 30 per cent of the oil in any conventional core sand mix. Additive increases tensile strength as much as 250 to 400 psi. Core sand mixes with this additive can be blown in production cores at high production rates. Material is furnished in 55-gal drums and no special preparation, other than adding it to sand mixes with the conventional core oils, is necessary.—**G. E. Smith Inc.**, Four W. Manilla Ave., Pittsburgh 20, Pa.

For More Details Circle No. 435—Page 39

HYDRAULIC FLUID

Fyre-Safe 225 is a fire-resistant hydraulic fluid of the water-glycol type. Advantages claimed include improved corrosion control in hydraulic systems, excellent heat transfer, and high conductivity. It contains 35-50 per cent water, yet it is said to possess a higher viscosity index than other water-glycol fluids. The high viscosity index combined with low pour point minimizes cavitation during cold weather start-up, resists mechanical shearing action, and provides excellent hydraulic efficiency.—**Oil Products Div., Nalco Chemical Co.**, 6216 W. 66th Place, Chicago 28, Ill.

For More Details Circle No. 436—Page 39

EPOXY METAL COMPOUND

Epoxy metal compound—a metal-filled resin and a hardener—sets in two to four hours and cures overnight. It can be used to fill, bond, and repair metal castings and patterns and also is useful in maintenance work. Material comes in half-pints, pints, quarts, gallons, and larger sizes. It is said to be resistant to most acids and alkalies, waterproof, and oilproof, and can be machined, filed, sanded, drilled, or tapped.—**Borden Chemical Co.**, Dept. H, 350 Madison Ave., New York 17, N. Y.

For More Details Circle No. 437—Page 39

PLASMA CUTTING TORCH

Plasma cutting torch is claimed to be capable of cutting conductive metals up to eight times faster than oxyacetylene devices. Cutting medium is a high-velocity, 30,000° F plasma flame, enabling the torch to

cut tungsten, titanium, monel, inconel, and stainless steel. Features of the torch are high-quality cuts, simple adjustments to cut a variety of materials, absence of customary heatup time, and wide tolerances in torch standoff distance.—**Plasmadyne Corp., a Giannini Scientific Co.**, 3839 S. Main St., Santa Ana, Calif.

For More Details Circle No. 438—Page 39

Circle 623, Page 39→

A NEW HEAVY-DUTY OVERHEAD TRACK BY CLEVELAND TRAMRAIL

TARCA TRACK

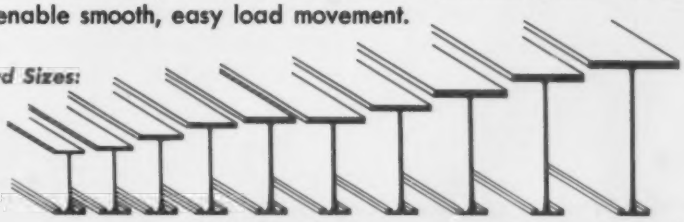
- **Completely new - - in design - - in fabrication**
- **Assures more years of heavy-duty service**
- **Great rigidity** ■ **Maximum strength with minimum weight**
- **Design readily proportioned to suit any load condition**
- **Overcomes track peening** ■ **Greater range of sizes**
- **New support fittings expedite erection**

Tarca Tracks are made under carefully controlled conditions. The three parts, top flange, web and alloy steel rail, are joined by continuous welds to form an integral one-piece section.

Cleveland Tramrail Tarca Tracks are a tremendous innovation in the overhead materials handling field. Another great improvement among many by Cleveland Tramrail to keep it far in the lead.

Tarca Tracks are straight, true, accurate—have flat raised treads—of hard, high-carbon alloy steel—prevent peening—provide greater wear resistance—enable smooth, easy load movement.

10 Standard Sizes:



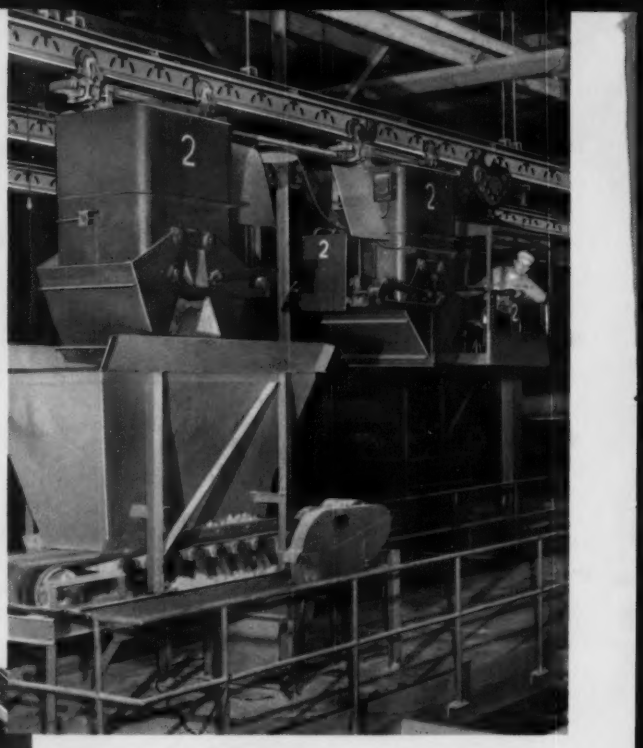
Sizes range from 8" to 20". Also special sizes are easily made to suit any overhead crane or monorail requirement. Tarca Track matches with existing Cleveland Tramrail track installations.

Ask for this helpful booklet—No. 2032

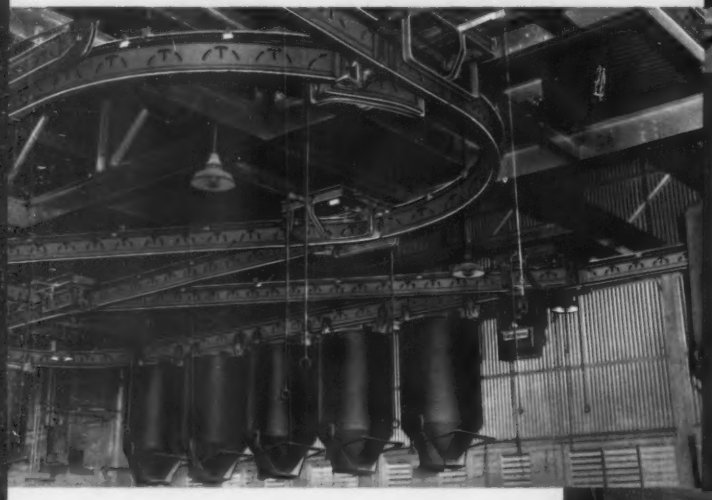
Covers all major features the buyer should know about overhead materials handling equipment. Has complete story on Tarca Track. Contains detailed equipment specifications and handy proposal evaluation form.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO
5899 EAST 284th STREET · WICKLIFFE, OHIO

Trade—mark of durability and strength —punched into all Tarca Tracks.

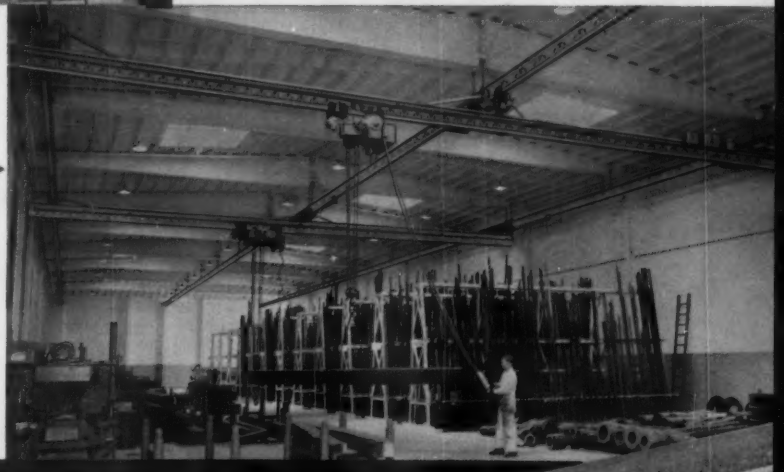


Cleveland Tramrail has an enviable reputation throughout the Ceramic Industry for outstanding performance. Customers have reported that their installations subject to heavy, continual usage are serving them far beyond expectations.



In the Glass Industry Cleveland Tramrail advanced a method of handling mixed ingredients in buckets traveling between mixer and furnaces which prevents segregation. This has proven so successful in assuring uniform quality that today the entire production of many glass plants is dependent upon equipment like that illustrated here.

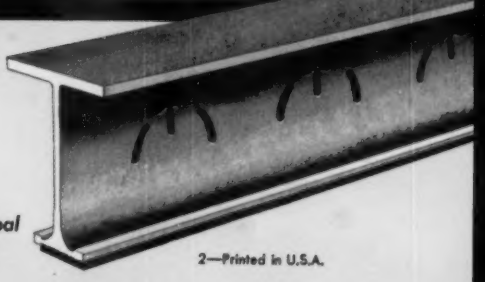
Cleveland Tramrail floor-operated cranes are such an important factor in handling heavy materials and cutting costs that there are now thousands of installations serving factories, mills and warehouses. Tarca Track is of real advantage for crane systems because of its great resistance to deflection.



Your Cleveland Tramrail Sales Engineer is Qualified to give you the Complete Design and Application Story on This Revolutionary

NEW TARCA TRACK

Cleveland Tramrail is represented by competent, experienced engineers in all principal cities of the United States and Canada. Contact address on other side.



2—Printed in U.S.A.

INDUSTRY BRIEFS

Sterling Aluminum Products Inc., St. Charles, Mo., has started production at a new 30,000-sq-ft permanent mold foundry at Carmi, Ill. Addition of this new plant is said to increase the annual capacity of Sterling and its subsidiaries by 12 million lb of permanent mold aluminum castings and to bring the total capacity to 110 million lb.

Birdsboro Corp., Birdsboro, Pa., has been awarded a $1 million contract by American Car & Foundry Div., ACF Industries Inc., to produce armor steel castings weighing from 200 to 2600 lb for the U. S. Army's new M-88 tank retrievers.

Cleveland Standard Pattern Works Inc. has moved its plant and offices to 2036 E. 77th St., Cleveland 3, Ohio.

Hills-McCanna Co., Carpentersville, Ill., has received a contract of undisclosed amount from the government of West Germany to manufacture large, light-alloy castings for turbojet engines to be used in German and NATO fighter aircraft. The castings will be made in aluminum, magnesium, and high-temperature alloys containing thorium and zirconium. They will be produced by the company's foundry division in Chicago.

Link-Belt Co. has moved its district sales office from 3592 Lee Rd., Cleveland 20, Ohio, to 3645 Warrensville Center Rd., Cleveland 22, Ohio.

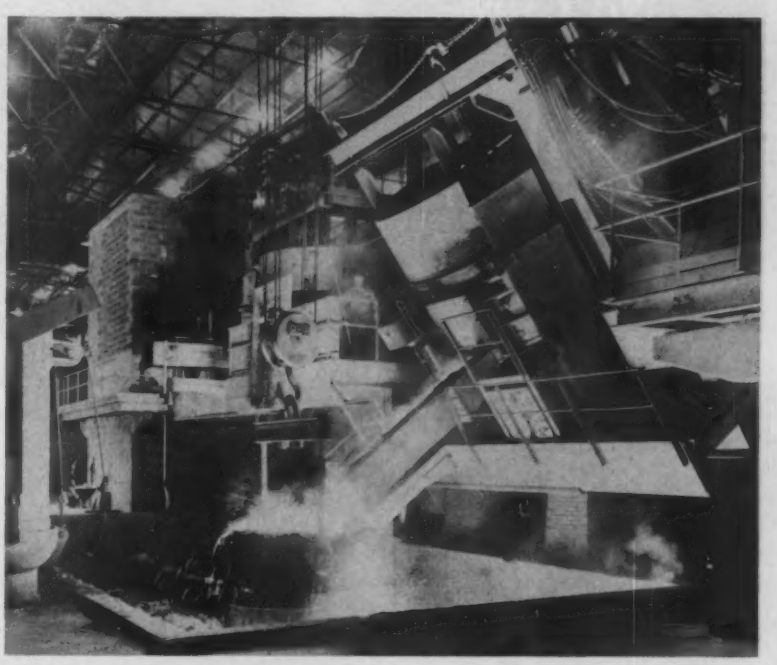
U. S. Reduction Co., East Chicago, Ind., suffered an explosion and fire which partially destroyed the smelting plant, killed at least four workmen, and injured more than 40 others. Damages were estimated as being "well in excess of $250,000." The company announced that it would get its first furnace back in operation within a week and would draw on its metal inventory until production could meet demands.

G. E. Smith Inc., Pittsburgh, has signed a license agreement with Silicatos Solubles De Mexico S. A., Av. Juarez No. 157-411, Mexico 1, D. F., for the manufacture and sales in Mexico of no-bake binder, hot box binder, and a series of washes.

Fulton Foundry & Machine Co., Cleveland, has discontinued operations, and the fixed assets have been sold. Purchasers are Dan Richman, president, Patterson Foundry & Machine Co., East Liverpool, Ohio, and Fred Richman, president, Triple A Machinery Co., Cleveland. The plant and the machine shop probably will be used for warehousing.

Cleveland Metal Abrasive Co., Cleveland, has appointed National Steel Car Corp., Hamilton, Canada, as exclusive Canadian distributor of the company's line of iron and steel abrasive shot and grit.

Latrobe Steel Co., Latrobe, Pa., has appointed Ramco Supply Co., 2444 E. 57th St., Los Angeles 58, Calif., to distribute its line of wear-resistant parts for metal casting and abrasive applications in California, Arizona, Nevada, New Mexico, Utah, and Hawaii.



STEEL WHEELS ROLL: Griffin Wheel Co., subsidiary of American Steel Foundries, Chicago, has constructed a new $6 million plant to produce steel wheels for railroad freight cars at Bensenville, Ill. Dedicated Oct. 10, it can turn out 148,000 wheels annually, bringing Griffin's total capacity to about 525,000 steel wheels a year. It is the company's sixth such plant. In this view, molten steel is tapped from one of two electric arc furnaces in the new plant. To make the wheels, air pressure is used to force steel up from an air-tight chamber into a graphite mold which can be used about 1000 times

←Circle 623, Page 39

...Positive Protection Against Molten Splash

One reason AO spats and leggings fill the bill on hot jobs is a specially-developed flare which *lies flat* in snug conformity with the shoe. It will *stay flat*, too, as shown in tests against all molten metals from lead to steel. One steel mill reported no curling in eight to ten weeks of constant use.

AO designed this "No Curl" flare to give positive protection against molten metal splash. It saves you money because it will last as long as the spats or leggings themselves, gives *up to four times* the service life of conventional flares.

You can choose from a full line of AO spats and leggings —all with the "No Curl" flare—in both chrome leather and asbestos uppers. For full details, call your AO Safety Products Representative, or write for folder S-6509.

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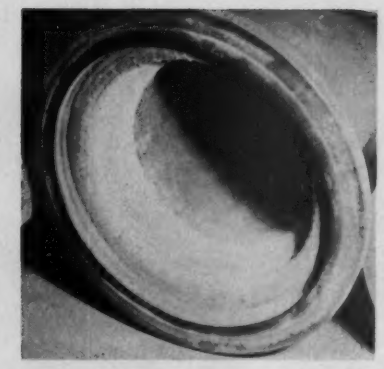
Welding Saves Heat-Cracked Pipe Molds

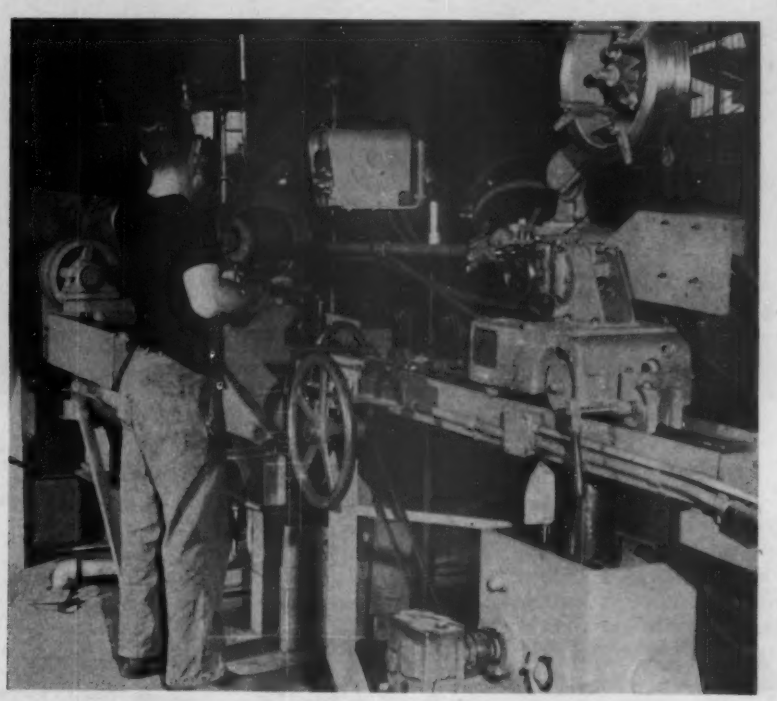
G. W. SMUCKER and W. PURCELL
Manager, Engineering Dept.
J. B. Clow & Sons Inc.
Bensonville, Ill.

Welding Sales Engineer
Linde Co.
Chicago



Before welding. The cracks in this pipe mold are typical of those that are caused by heat

After welding. Heat cracks have been filled by welding. The mold is ready for the machining operation



As the pipe mold revolves on rollers, the heat-cracked surface is covered with a continuous, spiral weld bead. The welding fixture can resurface up to 3 ft inside a mold

● HEAT CRACKS in pipe molds are a problem in cast iron pipe foundries. The steel pipe molds develop heavy cracking at the bell end due to centrifugal force and the heat of the molten iron.

Producers of cast iron pipe have found that these crack-formed cavities can cause severe flaws in the finished pipe. Centrifugal force causes molten iron to enter into the cavities and harden, resulting in rough pipe surfaces and edges. The cracks can be peened closed temporarily, but eventually they become so severe that the expensive molds must be replaced.

J. B. Clow & Sons Inc., Bensonville, Ill., solves the problem by welding on filler metal to build up the damaged area. With this process, proven in over 20 years in the pipe industry, Clow can return the mold to service as good as new at one-half the cost of a new mold.

Damaged molds first are machined and then placed on rotating rollers under a Unionmelt SH-2 welding head, which is equipped with an arm adaption mounted on an Oxweld CM-37 carriage. All equipment is supplied by Linde Co., Div. of Union Carbide Corp. By means of a special lead screw, the head moves forward at a speed of ½ ipm and the mold rotates at 10 to 12 ipm, making a continuous spiral weld.

A lever enables the operator to raise and lower the welding head to conform with the inner contour of the mold. The arm adaption, through which the welding wire and composition are fed, will permit resurfacing as far as 3 ft inside the bell end—more than adequate for the largest molds. After the welded surface is machined, the mold is as good as new.

How Frank Jones

John Warner (left), Foundry Superintendent, checks excellent finish on cast-iron elbow with Finishing Room Foreman Royce Barrett.

Operators Joe Pettigrew (left) and Wayne Walker (right) removing fins and parting lines from cast-iron fittings for soil pipe. They report the Bay State wheels they are using show less wear than any others they have used in spite of the fact that their cutting speed is much higher.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

helped Tyler Pipe lick a tough automation problem

These days, the very speed of automated production can turn out to be a headache instead of an advantage. In fact, a unique, automated pipe-casting process became just such a problem for Tyler Pipe & Foundry Co., of Tyler, Texas. Developed by Tyler's own engineering staff, the process enables the company to produce cast-iron pipe and fittings faster than any other known process or procedure.

The immediate result of this high-speed production was a serious bottleneck in the cleaning department where castings were finished. The snagging wheels in use simply couldn't keep up with the volume of work.

Rather than plunk a large investment into expanded facilities, Tyler's Purchasing Agent, R. S. Greenhaw, called in representatives of major abrasive manufacturers to see what they could do to break the bottleneck by boosting wheel performance alone. Among those called in was Bay State abrasive specialist Frank Jones who went over the whole snagging operation in detail. And the results paid off in substantially lower costs.

In plain figures, the Bay State wheel he recommended enabled the cleaning department to turn out over 20% more finished pipe and fittings per day than had ever been possible before.

All of which shows that Bay State's careful, analytical approach to grinding problems pays off in practical results. You'll find your own Bay State distributor and direct representative are equally well equipped by experience and thorough training to find practical solutions to your grinding problems. *Better grinding at lower cost... that is their business.*

Bay State abrasive specialist Frank P. Jones has not only had extensive experience in industry but has also had business college training. Consequently he knows which end of a balance sheet is up and says he figures that his business know-how makes his technical training doubly valuable. Proof of this claim lies in the first-class job he does for Bay State customers.

For More Information Circle 625, Page 39

Fig. 1—Furnace lining is checked and repaired before installation of new crucible

Fig. 2—Pedestal block is set carefully before new crucible is installed

Fig. 3—Refractory supports on either side of lip are installed to anchor crucible

Care Pays Off in

Handling of Crucibles

A few simple precautions can do much to extend the life of furnace crucibles and make this form of melting more economical. Here are the operating practices of two brass foundries which make the most effective use of their crucibles

● NORMAL CARE in the use of crucibles will return savings many times over the cost of the time required for the care. Here is how two brass foundries have developed operating practices which are designed to make the most efficient use of their crucibles.

Wolverine Brass Works, Grand Rapids, Mich., manufactures finished plumbing supplies such as valves and fittings. The brass foundry of this 65-year-old company operates 12 gas-fired crucible tilting-type melting furnaces, which have been found effectively suited for supplying the desired quality and quantity of metal. Usual charge of the 800-lb capacity furnaces is 200 to 300 lb of return scrap and the rest brass ingots.

The foundry is able to melt at a temperature which provides about one heat an hour and with economical fuel consumption. Life of the crucibles is about 120 heats or more.

According to F. W. Steketee, the foundry superintendent, Wolverine makes sure that it is getting high production of sound metal at a competitive cost by giving crucibles the attention they require. This calls for a small investment of time that brings savings in crucible life and performance.

First Step—Before installing a new crucible, which was unpacked on delivery and thoroughly dried before use, the furnace refractory lining is checked and, if necessary, repaired and patched (Fig. 1).

The crucible is set gently on the base block to assure level support when at elevated operating temperatures and to make sure that the bottom of the crucible is above the entire burner port to avoid being hit by the flame (Fig. 2).

After providing uniform clearance between the crucible and the furnace wall, to assure good flame travel, the refractory wedges are placed at the top edge of the cru-

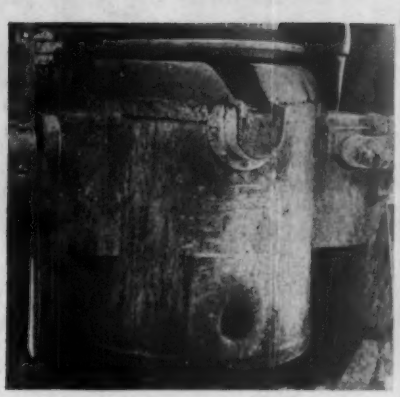


Fig. 4—After installation of new crucible, the furnace is ready for firing

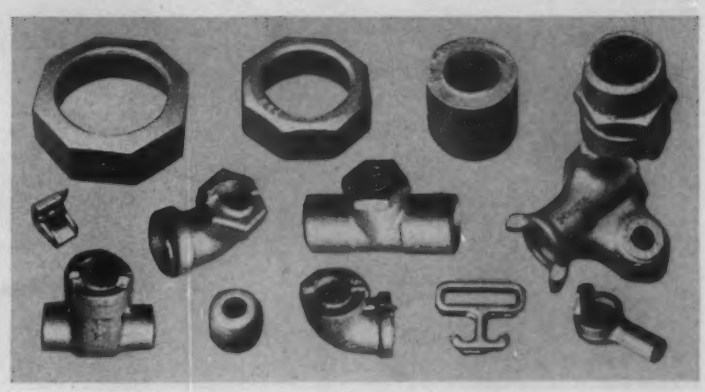


Fig. 6—Typical types of castings produced at Empire Brass Foundry Inc., Bridgeport, Conn., include plumbing supplies, electrical connectors, and similar parts

Fig. 5—Molten metal is poured directly from the furnace crucible into the pouring ladle and then is transported to the molding line

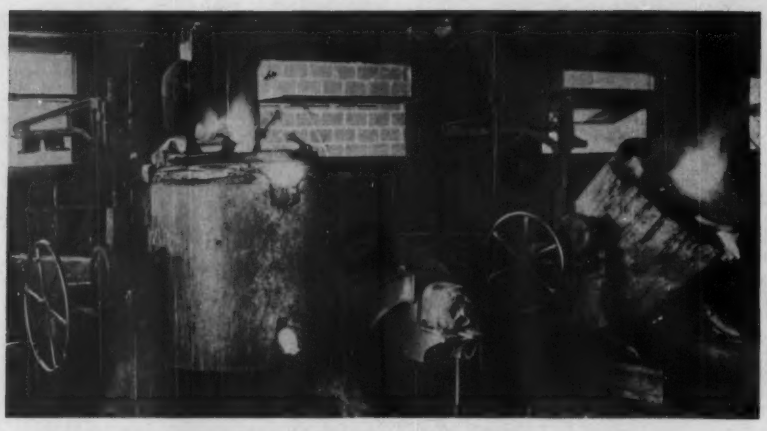


Fig. 7—Crucibles are charged from platform at rear of furnace. Note that the worker doing the job is equipped with tongs and full safety protection as he makes the charge

cible between the furnace lining on either side of the lip. This supports the crucible and metal weight when the furnace is tilted forward to pour and removes all weight and strain from the lip (Fig. 3).

The completed furnace with the cover placed 3 in. above the crucible top is shown in Fig. 4, and a pouring operation is shown in Fig. 5. The molten metal is transferred to pouring ladles and transported to the pouring floor.

Other Precautions—All other usual precautions are taken at Wolverine Brass to prolong the life of its crucibles and to get more production. The crucibles are charged carefully so that the metal will not hit the side of the crucible or wedge. The pouring ladle is handled with shanks designed to fit the ladle jacket and are checked regularly for roundness and proper taper, thereby preventing pressure which might crack the ladle and also assuring that the ladle will not fall out of the shank when the last portion of the metal is poured.

The first step in casting plumbing fixtures at Wolverine Brass makes certain that the machining and much other work to follow will be on a sound casting which has been economically produced. In this respect, proper attention in the use of crucibles plays an important role.

Empire Brass Foundry—From the time it started business in 1932, Empire Brass Foundry Inc., Bridgeport, Conn., has been using crucibles for melting metal because it feels no other type of melting is as well suited to its type of operation. Fig. 6 shows typical castings produced at Empire Brass Foundry.

As soon as crucibles are received from the manufacturer, they are unpacked and stored in a warm, dry place for about two weeks, longer if possible.

All of this foundry's crucibles are for tilting type furnaces, using oil fuel with regulator valves, manually operated. Each type of metal has its own crucible. This is in the interest of getting good, sound castings. In addition to the daily cleanings, all crucibles are cleaned and furnace linings checked once a week while cold. Any necessary repairs to furnace covers and linings are done at this weekly checkup.

Charging is done from a platform at the rear of the furnaces, as shown in Fig. 7. Special care is taken to avoid wedging, because metal expands more than the crucible and this could cause the crucible to crack. Also, the metal is lowered carefully so as not to drop against the crucible wall, which could damage the crucible. These simple precautions can add many heats to the life of the crucible, thus substantially reducing the replacement costs.

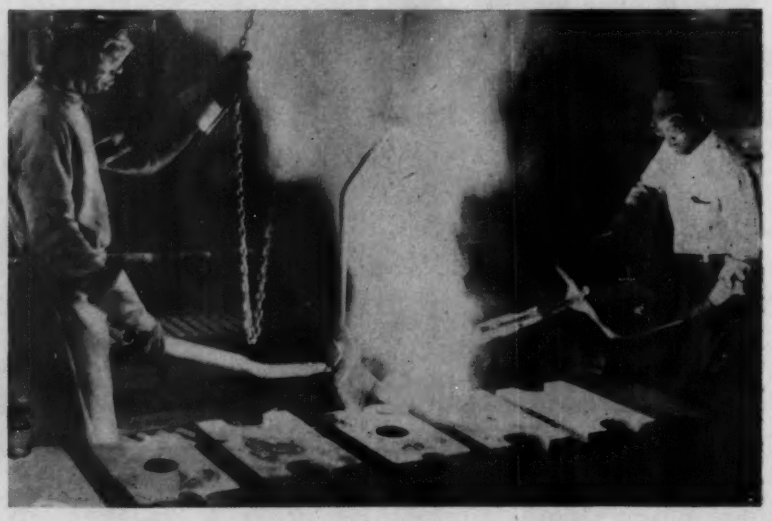
Pouring is done from the tilting furnace into a crucible which is carried by overhead track to sand molds. Effort is made to have the molds ready for pouring when the metal is ready (Fig. 8) because soaking—leaving the crucible under fire in the furnace after the metal is ready—may decrease the normal life of a crucible and also increase the fuel cost.

Shanks are designed to fit the pouring crucible and are regularly checked for roundness and taper so the crucible will rest at the point of contact that will assure proper balance when pouring.

Although this foundry's practices represent nothing especially involved or costly, they contribute a great deal to the economical production of castings.

Editor's Note: Data and photos courtesy of the Crucible Melting Information Bureau of the Crucible Manufacturers' Association, 55 Public Square, Cleveland 13, Ohio.

Fig. 8—Sand molds usually are prepared before metal is melted so that molten metal is not soaked or overheated. Pouring is from crucibles



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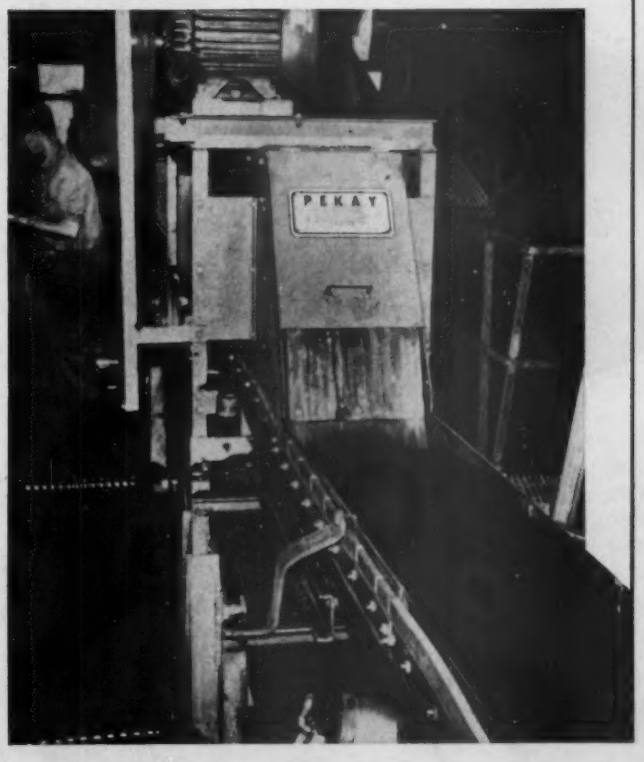

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Speakers at the meeting included, from left to right, F. Kermit Donaldson, executive vice president, SFSA; W. H. Moriarty, president, SFSA; David S. Teeple; William L. Swager; and Dr. C. Wilson Randle

Industry Needs Analyzed at

Steel Founders' Fall Meeting

By WILLIAM G. GUDE
Editor

● PRINCIPAL needs of the steel castings industry are cost reduction, product improvement, more basic research, and greater sales promotion through advertising and publicity.

Speaking before the fall meeting of the Steel Founders' Society of America at The Homestead, Hot Springs, Va., Sept. 25-26, SFSA President Wilson H. Moriarty listed these requirements in reviewing the industry's position and the society's activities. Mr. Moriarty, first vice president and group executive, National Castings Co., Cleveland, presided at the 59th fall gathering of the society.

He pointed out that a number of the steel founders' problems are not peculiar to them alone; producers of competing products also are troubled by low prices and reduced profits.

The relatively low operating rate of steel foundries in recent years is somewhat misleading, Mr. Moriarty explained. Wartime expansion of plants provided capacity in excess of immediate peacetime requirements. Average yearly production of 1,182,000 tons in 1956-60 was only 72 per cent of wartime output, but it was 66 per cent larger than the 1936-40 average.

The speaker reviewed briefly some of the more important activities of the society's various committees. In the area of promotion, the first of a series of national adver-

View of a session at the SFSA fall meeting, held Sept. 25-26 at The Homestead

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tisements has appeared. Approximately 6000 copies of the new *Steel Castings Handbook* have been distributed. The Technical and Operating Committee is planning its annual conference for Nov. 13-15 in Cleveland.

Seven foundries having an accident frequency rate of less than 5 participated in a new type of contest conducted by the Safety Committee. Entrants were judged primarily on the quality of their safety activities. The winner was Oklahoma Steel Castings Co., Tulsa, Okla., which recently experienced

Society President W. H. Moriarty presents a special safety award to R. C. Harvey, sales manager, Oklahoma Steel Castings Co., for his company's outstanding safety record

no lost-time injuries during 650 days and 1,124,534 manhours of work. R. C. Harvey, sales manager, accepted the award for his company.

Technological Change — Today's heavy expenditures by industry for research and product development will affect our technology three to seven years from now, the usual lag time. This prediction was made by William L. Swager, assistant manager, Department of Economics and Information Research, Battelle Memorial Institute, Columbus, Ohio.

Changes likely will be more pronounced in the future than recently, he pointed out, because such expenditures were only $3 to $4 billion in 1955 but are $14 to $14½ billion today and may go to $25 billion by 1970. Changes will occur in the technology of both the foundry and its customer, but those of the latter are the more important and should be anticipated if the foundry is to capitalize on such developments. These changes offer both threats and opportunities.

Mr. Swager cited a number of developments now under way, including the pumping of fluidized solids, large bulk handling conveyors, electronic transportation of information, and conversion of fuel to electricity by the fuel cell. Increasing problems in mass transportation will dictate changes in that field, he indicated.

He recommended that both individual foundries and the society attempt to identify the important technological developments ahead and to analyze customers' needs three to five years in the future.

Business Success — Speaking on "Factors Behind Business Success," four major problems were listed by C. Wilson Randle, partner, Booz, Allen & Hamilton, Chicago. These problems are labor costs, foreign competition, shortage of executives, and product life cycles. The impact of wage increases varies by industry, and their effect on an industry's competitive position in world markets also is not uniform among all types of producers. Today 69 per cent of the 1000 largest U. S. companies have manufacturing facilities abroad.

The problem of a coming executive shortage is created by the fact than in 1970 there will be 2.6 per cent fewer men in the 30-44 year age group than there are today, and the number of executives needed has been rising.

The product life cycle is shortest for these industries closest to the consumer, longest for basic industries. Many companies have failed because they did not expand their product line to compensate for the eventual deterioration of markets for their existing products. Mr. Randle emphasized that since profits start down while sales of a given product still are rising, the making of new product additions should be keyed to the profit cycle.

Currently 48 per cent of all expenditures for research and developments are for new products, 41 per cent for improvement of present products, and 11 per cent for new processes.

It is top management's responsibility to establish realistic objectives (research generally is needed to do this), define these objectives properly and keep them updated,

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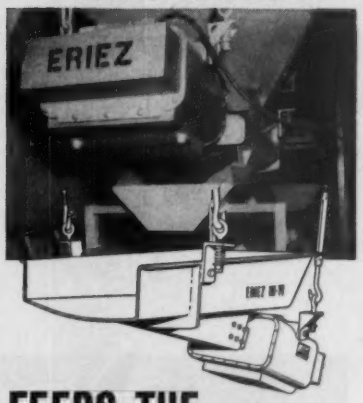

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and institute effective plans for meeting these objectives.

Japanese Industry—Following the showing of the Japanese film, "Toshiba in Progress," F. Kermit Donaldson, SFSA executive vice president, described his recent visit to various steel foundries of Japan.

Quality of Japanese castings, he said, is high. Primary markets for the 364,000 tons produced last year were iron and steel mill equipment, machinery, construction, shipbuilding, and railroads. Electric furnaces melt 93 per cent of the steel; the industry has 315 arc furnaces, 91 induction units, and 13 open hearths.

The Japanese are actively engaged in research work and in use of nondestructive testing. Production is rising, and eventually the country could become more competitive with the United States.

Productivity of Japanese steel foundries is 1½ tons per man per month. The work period is 55 hours per week. Although the monthly average wage is only $95, substantial fringe payments, such as summer and year-end bonuses, are about equal to the base labor cost.

Progress report of the Program Evaluation Committee was presented by its chairman, C. E. Grigsby, vice president, American Steel Foundries, Chicago.

Concluding the program was a discussion of "Business and Political Communication" by David S. Teeple, atomic energy and research consultant, Washington. He urged that businessmen participate actively in government and politics on all levels.

Refractories Directory Offered

The Refractories Institute, Pittsburgh, has just published the 1961 *Product Directory of the Refractories Industry in the United States.* The 224-page directory lists 3548 different brands of refractories for the lining of industrial furnaces and the 170 companies who make them.

Special sections are devoted to manufacturers' names and addresses, plant locations by state and city, product divisions, and a complete list of brand or trade names. Copies are available for $4.50 from the institute, First National Bank Bldg., Pittsburgh 22, Pa.

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New Quik-Sett NB is a concentrated furan-type resin binder for large sand molds and cores that cure thoroughly at room temperature. Sand surfaces are exceptionally smooth and hard, producing excellent surfaces on castings. Because it cures by catalytic polymerization, without oxidation or baking, handling is reduced to a minimum—time and money are saved.

No irritating fumes

Most furan-type binders available to date have produced a strong, irritating formaldehyde odor because the formaldehyde was loosely combined with the resin. This objectional characteristic has been eliminated in Quik-Sett NB through precise resin control and special compounding procedures. The result is a concentrated resin that produces no persistent odor during working and curing.

Cores and molds made easier and faster

Total mulling time is only 2 to 7 minutes producing a mix with excellent flow characteristics. Because the mix flows readily, no ramming is required in setting up the core or mold. Little more than hand tucking is needed to fill all voids in the pattern.

Since cores and molds of Quik-Sett NB have superior early strength, rodding is drastically reduced. Usually only a bottom and top web, to anchor hooks, is ample.

Other features of Quik-Sett NB

- Simplified binder-catalyst process
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- Accurate dimensional stability
- Excellent storage characteristics

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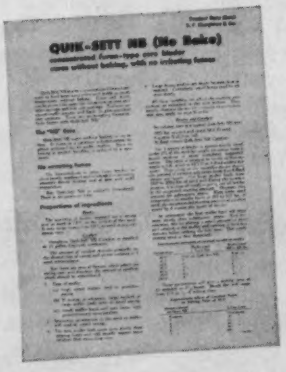

Get the whole story on this new development in no-bake sand binders. Whether or not you have used or are now using this type of material, you will be interested in what Quik-Sett NB will do—the many advantages it has over conventional no-bake binders. Write for your copy of the new bulletin describing Houghton Quik-Sett NB. And if you wish, we'll gladly *show* you what it will do in your foundry—on one of your jobs. E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia 33, Pa.

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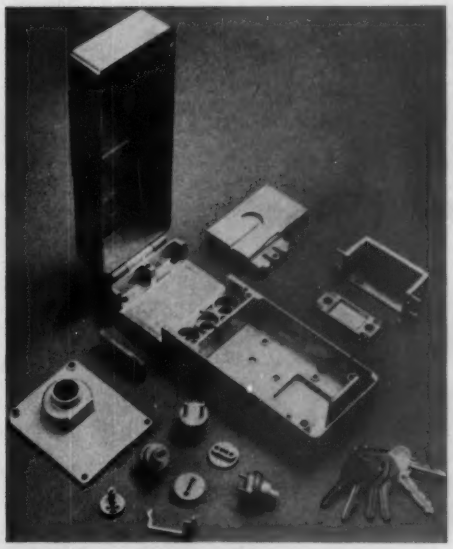
Zinc Diecasting of Year

● ALTHOUGH it weighs less than half an ounce, a counter assembly for an elapsed time indicator was judged 1961's "Zinc Die Casting of the Year" in the annual industry-wide competition sponsored by New Jersey Zinc Co., New York.

The subminiature counter assembly, smaller in circumference than a dime, is diecast by Hadlock & Temte Inc., Chicago, for the Bowmar Instrument Corp., Fort Wayne, Ind. For their contributions to the successful design and production of the precision castings, checks for $500 were awarded to Melvin E. Guillaume of Bowmar and Donald H. Hardey of Hadlock & Temte.

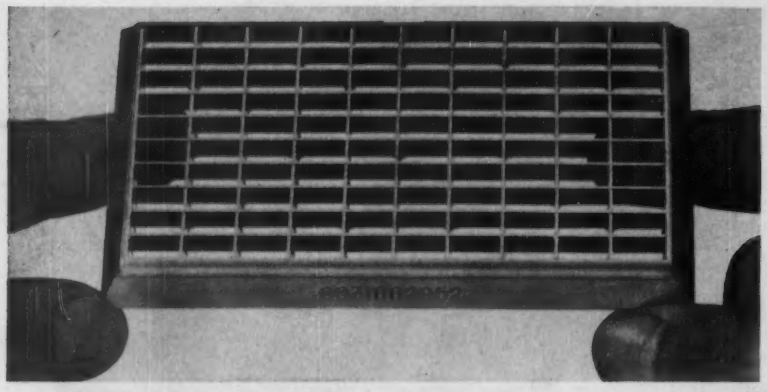
The prize-winning assembly consists of a two-piece housing, four counter wheels and five tiny gears, the smallest of which is a ten-tooth bevel gear .063 in. high. A close degree of accuracy is essential. Unit cost savings of 91.5 per cent were achieved by zinc diecasting, which replaced machining the housing from aluminum bar stock and the gears and counter wheels from brass.

All openings in the housing are diecast, even the small crescent-shaped slots in the sides which per-



Basic lock assembly, utilizing 15 zinc diecastings, can be used for 28 different types of door installations. Each half of the lock case has a cast projection to form the hinge

Engraved steel print wheel, right, costs $8.50 apiece. Zinc diecast wheel, left, costs only 35 cents. Interchangeable dies make casting wheels with various characters a simple matter



Diecast ventilation louver for an aircraft navigation equipment case features 100 tiny openings. The contoured ribs are only 0.025 in. thick

mit the outermost gears to clear the housing walls. Tooling cost for the 11 castings was $14,000, and Bowmar expects no difficulty in amortizing these costs easily at present production rates.

Judges this year were William G. Gude, editor of FOUNDRY; Burnham Finney, editor of *American Machinist/Metalworking Manufacturer;* and George C. Nordenholt, former chief editor of *Product Engineering.* The annual competition is conducted by New Jersey Zinc as a means of bringing recognition to the diecasting engineers and designers who are making important contributions to the growth of the industry through their skill and imagination.

The grand prize winner is the heart of Bowmar's Model 1440 miniature elapsed time indicator (ETI). This is a decimal-type counter with unusually large characters for easy read-out at distances up to 6 ft. It is used on digital computers such as the Army's FADAC (Field Artillery Digital Automatic Computer), where it determines the amount of time FADAC has operated, permitting equipment checkout at specified intervals.

The Bowmar ETI is in contrast to the standard, concentric circle-dial type indicator. The latter has numbers only a few hundredths of an inch high, whereas the Bowmar unit displays four white numerals approximately 1/8 in. high and provides readings from 0000 to 9999 hours with return to 0000. Completely self-contained, including the motor, the unit is filled with inert gas and hermetically sealed. It must conform to military specifications.

Dimensions on the gears are all plus or minus .001 in., and all gear-included angles are held to 15 minutes. Depth of the tooth structure on the counter wheels is .023 in., plus or minus .001 in. All dimensions on the housing are held to plus or minus .002 in.—with one important exception. The two posts of one half of the housing must fit snugly into corresponding holes in the other half of the housing. Hole diameters are thus held within .0005 in.

The posts not only serve to keep the two halves firmly together, but also to align them perfectly. This alignment is important, since the shafts for the counter wheels and gears are friction fit into mounting holes in each half of the housing.

The castability and dimensional stability of Zamak were factors in permitting these almost microscopic gears and their precise housing to be diecast.

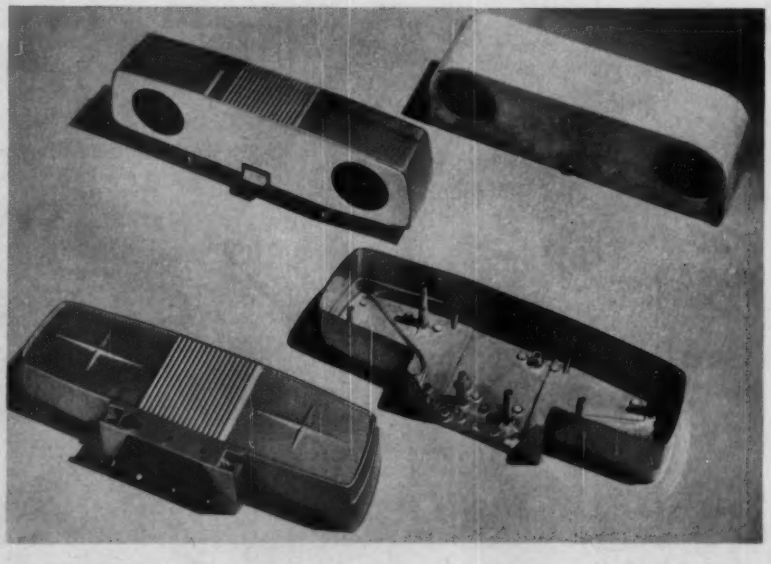
Nine Awards of Distinction were made by the judges for outstanding castings. Covering a wide variety of applications and design problems, they show the art of zinc diecasting at its best. Award winners were the following:

A. C. Boultinghouse, Withrow Die Casting Co., Hollywood, Calif., and Leonard Maletz, Hoffman Electronics Corp., Los Angeles—Ventilation louver for aircraft navigation equipment case is a functionally superior unit and is diecast at half the installed cost of the stamping it replaced.

A. Bucher, Springfield Die Casting Co., Kenilworth, N. J., and G. E. Tranter, Brown Instrument Div., Minneapolis-Honeywell Co., Philadelphia — Instrument print wheels are diecast at unit cost of 35 cents each, compared with average cost of $8.50 for wheels engraved from steel.

M. E. Johnson, Falconer Metal Specialties Co., Lakewood, N. Y., and Louis Cohen, Phelps Time Recording Lock Co., New York — Time-recording lock assembly is adaptable to 28 different types of

Contrast in appearance between a chrome-plated zinc diecast lampholder and the steel stamping it replaces, upper right, is evidenced



Circle 632, Page 39→

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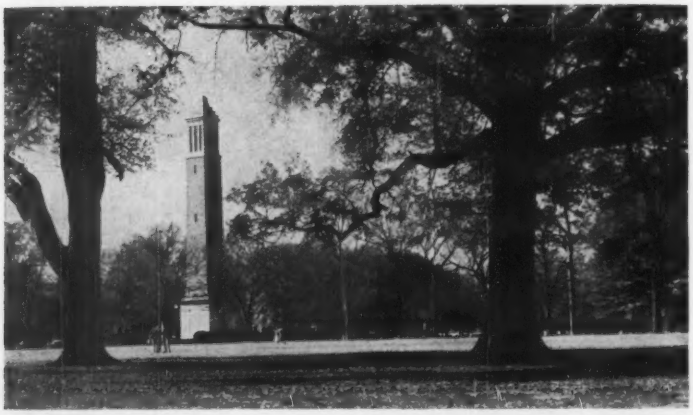
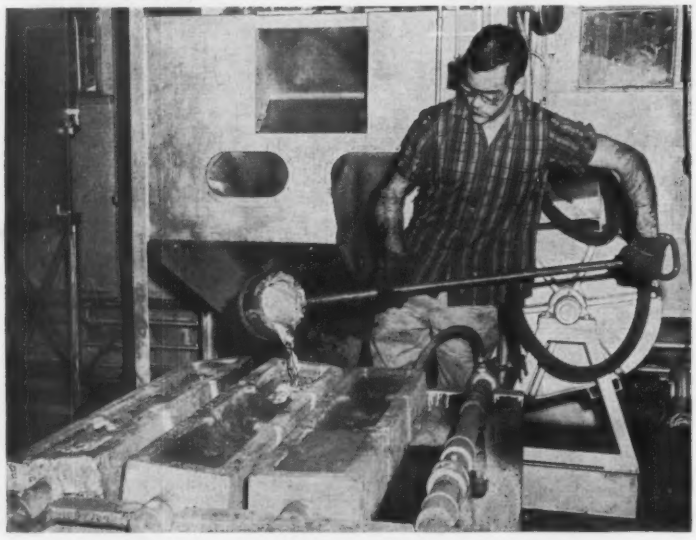
CAST METALS IN ENGINEERING EDUCATION . .





H. D. BRADSHAW

E. C. WRIGHT

R. L. FARABEE

Cast metals study is under the direction of Prof. E. C. Wright, head of the Department of Metallurgical Engineering. He is ably assisted by Prof. Ray L. Farrabee and Harry D. Bradshaw. Professor Bradshaw is a former FEF scholarship and Wheelabrator Fellowship holder.

THE UNIVERSITY of ALABAMA

On December 18, 1820 the General Assembly of the State of Alabama passed an Act establishing the University of Alabama. It was open for admission of students on April 18, 1831. The University is situated at Tuscaloosa, a city of approximately 60,000 situated in the West Central part of the State, just 60 miles from Birmingham. This location, close to one of the nation's great foundry centers, is especially fortunate for engineering students.

On April 4, 1865 most of the university buildings were burned to the ground by a body of Federal Cavalry. Classes resumed in April, 1869. In 1884, the Federal government donated 72 sections of public land within the state in restitution.

Engineering instruction was established in 1837 and organized as a separate division in 1909. At the present time this college embraces the Departments of Aeronautical, Chemical, Civil, Electrical, Industrial, Mechanical, Metallurgical, and Mining engineering.

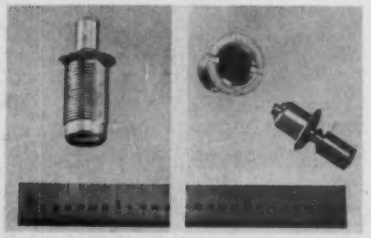
The FEF program was inaugurated at the University of Alabama in 1949. Since that time several hundred engineering students have enrolled in the nine courses involving cast metals—four of which are devoted exclusively to foundry operations. 116 FEF scholarships have been awarded to capable and deserving engineering students during the last 11 years. A great number of these FEF scholarship holders have accepted employment in the leading foundries in the state of Alabama.

FOUNDRY EDUCATIONAL FOUNDATION, Terminal Tower, Cleveland, Ohio

The Foundry Educational Foundation does not pay for this advertising. This advertisement has been prepared and the space contributed by FOUNDRY magazine in support of FEF's constructive program for foundry industry progress through education.

doors. The basic assembly is made up of 15 different diecastings and provides valuable production economies.

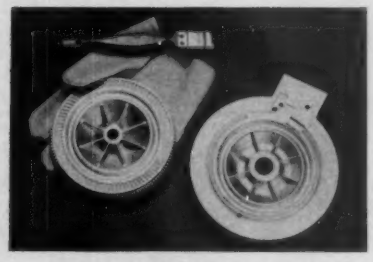
E. Natkins, Gries Reproducer Corp., New Rochelle, N. Y., and



Spring-loaded pushbutton fastener

Camloc Fastener Corp., Paramus, N. J.—Housing and cams for pushbutton fastener used for rapid access to panel assemblies makes use of three mating diecastings.

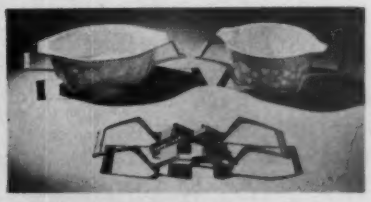
W. G. Treiber, Chicago White Metal Castings Co., Chicago, and Bruno Enssle, Binks Mfg. Co., Chi-



Spray equipment control plates

cago—Diecast rotor and backplate are key components in timer unit for automatic spray equipment.

Jack J. Punke, Cast-O-Matic Corp., Syracuse, N. Y.—Diecast cra-



Adjustable cradle for casseroles

dle for casseroles and bowls consists of two parts which are quickly adjustable to accommodate any shape and size of container. They are made exclusively for Corning Glass Co.

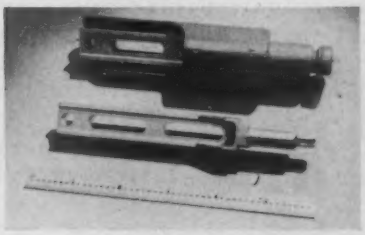
David Morgenstern, Nelmor Mfg. Co., Euclid, Ohio—Diecast turret lampholder for fluorescent light fixtures provides a more attractive and more efficient unit but is priced competitively with the steel stamping it replaces. It was designed for the Electroline Mfg. Co.

K. B. Morrison, Newton-New Haven Co., New Haven, Conn., and L. R. Knauer, Colt's Patent Arms Mfg. Co., Hartford, Conn.—Civil War centennial pistol is a working model, four-fifths full size. All but the trigger, hammer, and handgrips are diecast. The barrel is rifled, and

Civil War centennial pistol

the pistol is said to shoot (.22 caliber) accurately.

Ernest Ike, Western Die Casting Co., Emeryville, Calif., and H. Arneson, Jandy Products, San Anselmo, Calif.—Diecasting is used to



Strengthener for plastic coupler

strengthen a plastic coupler used to attach cleaning heads to a swimming pool pole.

Publishes Lighting Handbook

Reprint of the official Lighting Handbook of the Illuminating Engineering Society shows recommended levels of illumination for every task as they have been approved by IES Council.

The new reprint contains 16 pages and may be obtained at 20 cents a copy from the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y. Discounts are given for handbooks purchased greater amounts.

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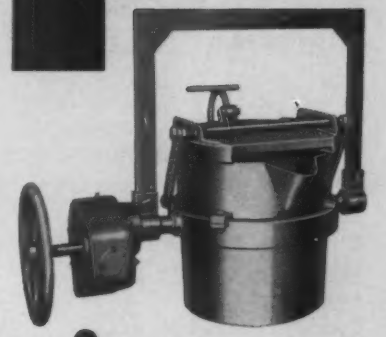

industrial

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TYPE 10 BCR incorporates all the "big ladle" features for precision control—yet it's specially designed for easy, one-man handling of the entire pouring operation. Offers these features to assure safe, fast and accurate performance: Easily removable sealed Anti-Friction Trunnion Bearings; Taper Side Welded Bowl with Lugs attached; Bowl Cover; and Universal Square Bail drilled for Distributor.

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For More Information Circle 634, Page 39

METALGRAMS

UNION CARBIDE METALS

. . . news of "Electromet" ferroalloys and metals

NOVEMBER 1961

FOR HOT, FLUID IRON -- "EM" foundry carbide, a new exothermic material added to the cupola, produces hot, fluid iron with no initial investment in hot-blast equipment. One per cent foundry carbide by weight of the metal charge raises iron temperatures by 50 to 60 deg. F. Two per cent adds 100 deg. F. The carbide also helps produce hot cupola startups and rapid temperature recoveries after shutdowns.

* * *

HIGHER QUALITY IRON, LOWER COSTS -- By making iron more fluid, "EM" foundry carbide improves castability. Slag separation is also more complete. Castings are less likely to have gas defects, unsoundness, and chilled corners. The high temperatures produced by foundry carbide eliminate bridging and promote trouble-free melting. Since silicon recoveries and carbon pickup also improve, large amounts of steel scrap and other low-cost materials can be charged. Thus, foundry carbide allows savings in material costs. Write for booklet F-61-0119.

* * *

DUCTILITY AND IMPACT PROPERTIES IMPROVED -- Nearly all carbon steel fourdries deoxidize with aluminum. In so doing, some Type II intergranular sulphide inclusions usually form. These sulphides give poor tensile bar fractures, with low reduction-in-area values. They also lower impact strength. When calcium-silicon or calcium-manganese-silicon is added with aluminum, random Type III sulphide inclusions form. Since Type III inclusions have much less effect on properties than Type II, ductility and impact values will be higher. For information on how one foundry uses calcium-manganese-silicon to obtain extremely high properties, write for the article, "Ca-Mn-Si Boosts Casting Quality," in the Winter-Spring 1961 issue of UNION CARBIDE METALS REVIEW.

* * *

INTEREST IN COLUMBIUM STEELS GROWS -- For many years, columbium has been used to (1) prevent intergranular corrosion of 18-8 stainless steels, allowing welding; (2) reduce air hardening in plain-chromium stainless steels; and (3) increase the high-temperature strength of high-alloy compositions. Further information on these uses can be obtained by writing for booklet F-20,113 or circling 551 on page 39 Recently, many foundrymen have shown interest in the improved strength and weldability of mild-carbon steels, obtained by wrought producers, by adding up to 0.03 per cent columbium. Information on these steels can be obtained by writing for the article, "Columbium in Carbon Steels," in the Fall 1961 issue of UNION CARBIDE METALS REVIEW or circling 552 on page 39.

* * *

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FOUNDRY DEVELOPMENTS

By EDWIN BREMER
Metallurgical Editor

Ductile Molybdenum

PRODUCTION of molybdenum of exceptionally high purity and good ductility in the as-cast condition is reported by Oregon Metallurgical Corp., Albany, Oreg. The metal is produced by reducing molybdenum sulfide with tin and it contains less than 20 ppm each of carbon, oxygen, and nitrogen, and less than 50 ppm of sulfur. In the as-cast state the molybdenum shows a yield strength of 37,000 psi, a tensile strength of 46,000 psi, elongation in 4 D 3.5 per cent, and reduction of area 3.2 per cent at room temperature. Work was performed under a Bureau of Naval Weapons contract.

Glycol in Molding Sand

EXTENDED study of the practical application of glycol additions to molding sand for producing copper-base alloy castings showed good results in a German foundry.

Described in an article, "Experiences with the Application of Glycol-bearing Molding Sand," by Brunhuber and Christochowitz in the July issue of *Giesserei* (Dusseldorf, Germany), the authors found that the glycol additions produced surfaces on the castings approaching those obtained in shell molding. The sand also almost completely eliminated the mold-metal reaction. No important effect on molding sand properties is said to occur through the glycol additions.

Sound Gray Iron

RECOMMENDATIONS to aid in producing better gray iron castings are presented in "Dimensional Accuracy and Soundness of Grey Iron Castings Produced in Green Sand Moulds" by Nicholas and Roberts in the July, 1961 issue of *BCIRA Journal* (Birmingham, England). They are: 1. Reduce the moisture content to its lowest practical value. 2. Make appropriate additions to the molding sand.

Most effective sand addition is pelleted pitch. Other additions in general use which have a similar but lesser effect are coal dust and wood flour. Unlike pitch, however, those additives affect the green sand properties and may necessitate an increase in moisture to retain the same molding properties. Molds must be rammed firmly.

Improved Motors

FIRST of a new line of cylinder blocks is being shown by Leo C. Croce to Eugene R. Streets, works manager, Clinton Engines Corp., Maquoketa, Iowa, where they are cast. Blocks are shell molded and made of nickel-chromium cast iron. They are used in a new Clinton engine termed Dynaspark. It utilizes an ignition system which

eliminates magneto, condenser, coil and points of the conventional system; reportedly it is the first application in the small gasoline engine field.

Spray-on Strain Gages

HIGH-TEMPERATURE strain gages now can be flame-sprayed onto metal surfaces, according to Boeing Co., Seattle, Wash. Previous practice was to make the strain gages separately and cement them to the surface to be tested. Boeing's method is to flame-spray the metal onto the surface through a stencil. Accuracy is reported to be as high with the sprayed-on gages as with the standard type. They have withstood temperatures up to 1200° F, and expectations are that the limit can be pushed past 2000° F.

New Alloy Steel

RECENT development by Kolcast Division, Thompson Ramo Wooldridge Inc., Minerva, Ohio, is an alloy steel designed to bridge the gap existing between stainless steel and the superalloys. Termed SR alloys, they are said to be austenitic, nonmagnetic and age-hardenable, and provide higher yield and tensile strengths than stainless steels at room and elevated temperatures.

These alloys are used to produce investment castings by Kolcast. They show tensile strength up to 120,000 psi and yield strength up to 105,000 psi, and have suitable strength up to 1600° F. The SR alloys are basically steel and do not rely on higher cost elements such as cobalt, columbium, titanium, or zirconium.

High Pressure Designing

STUDY of various strength theories and methods of obtaining high strength chambers for hypervelocity launchers developed a set of equations for the design of cylindrical and spherical high-pressure vessels. Validity of the equations has been demonstrated in the design of several gun systems and by use of strain gages which indicated their practicality in the elastic regions for both shrink fit and autofrettage construction.

Details are available in "Elastic and Plastic Stress Equations for Hollow Cylinders and Spheres Subjected to Internal and External Pressure" by V.C.D. Dawson. Report is designated PB 171,684, and may be obtained from the Office of Technical Services, U. S. Department of Commerce, Washington 25 for $1.25.

AT THE HEART OF INDUSTRY...

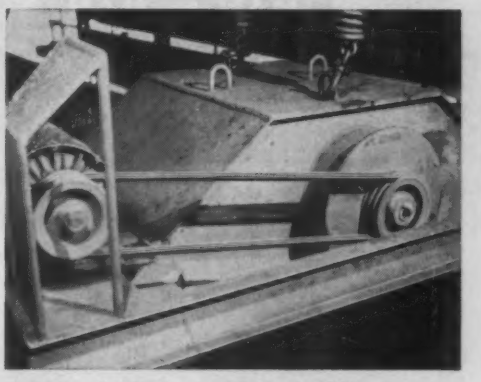
In the tough jobs like this one, U.S. Rainbow® Sandblast Hose demonstrates its exceptional qualities most clearly. Carrying sand or steel shot after other hoses have been worn useless, this US hose provides safety as well as long wear. Its durable rubber tube is especially treated with a highly conductive material to dissipate static electricity, and its strong carcass flexes easily to prevent kinking and simplify control of the discharge end.

M 122

Helping to increase efficiency in difficult foundry tasks, US Industrial Rubber Products make these jobs quicker, less fatiguing, more profitable. As the world's largest producer of Industrial Rubber Products, US not only keeps posted on the needs of foundry-type operations, but supplies the products to fill them.

"Takes terrific heat and loves it" aptly describes the US HTB Glass Fabric Belt. Unlike competitive hot materials belts, the US HTB eliminates premature splice failure and abrasion wear, prevents early heat aging. Thoroughly tested on the toughest jobs, the US HTB gives maximum performance under the highest operating temperatures.

CB 111



U. S. Royal V-Belts provide top efficiency, exceptional length stability, uniformity on all types of drives. These belts were especially chosen for this job because they give maximum reliability, safety, and profitable running. On jobs throughout industry, U.S. Royal V-Belts are known for their exceptionally high torque transmission and because they eliminate so many metal parts.

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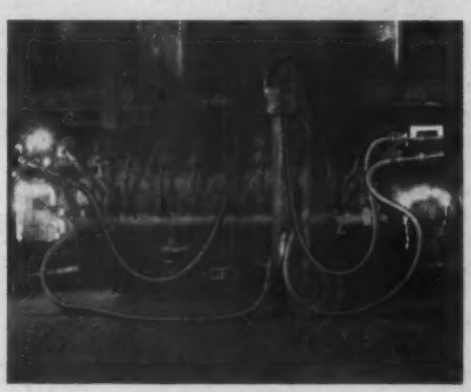

Kaiser Steel depends on U. S. Peerless® Water Hose to prevent costly pipe skid burn at its Fontana, California, mill. This premium-quality general-purpose water hose, here carrying both cooling and heated return water, has demonstrated its superior resistance to age, abrasion, heat, and pressure in applications throughout the entire metal working industry.

H 133

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MECHANICAL GOODS DIVISION

For More Information Circle 635, Page 39

By RALPH L. LEE, *President*
Lee Hobby Foundry, Birmingham, Mich.

Mechanics and Humanics

"Foundrymen need not crawl under a rock when learned people speak in a foreign language about the things they know inside and out"

● SOMETIME AGO, I read the transcription of a brilliant speech by one of the nation's top scientists and educators before the graduating class of an equally distinguished engineering school.

He laid great stress on the fact that our recent technical achievements—such as in engineering systems, jet engine developments, data processing innovations, nuclear submarines, satellite communication networks, inertial guidance systems, and automated production lines—were brought about by organized science.

He implied that the old-fashioned inventor, working on his own, on a cut-and-try basis, although he had given a good account of himself in the past, is pretty much out of date. He insisted that new developments, as never before, would depend on organized research in the laboratory and on a new order of scientific insight, mathematical power, and analysis.

Still Cut-and-Try — I couldn't help think, having read the newspapers about our experience with rockets and manmade satellites, that in spite of our regimented technological efforts and our multimillion dollar research setups, quite a sizable hunk of cut-and-try still remains.

I imagine that many of the graduates who heard this brilliant address left the hall with a thrill of life along their keels, girding up their loins with a determination to measure up to the great challenge the future would impose on them. I'll just bet, however, that many of the not quite so brilliant left in sort of a tizzy, wondering whether they ever could measure up to the complexities of this new day and age and afraid to think all by themselves.

Not too long ago after this occasion I made a speech before an engineering society at the General Motors Research Center.

"Love that Sand Symposium!"

Its personnel director buttonholed me with this comment: "Doc, our greatest problem is to blast the rank-and-file members of our research staffs from their consciousness of organization rank and to cut loose on their own, to use their heads as individuals, and to share the results bravely with others."

"Yes," I said, "I imagine you're right. After all, when you get right down to it, an organization can't do anything. Only the individuals in it can."

"Right!" he said.

For example, I have placed the October, 1961, issue of FOUNDRY on my library shelf right alongside the dictionary and a row of dog-eared and much-thumbed reference, text, and handbooks. Being a nut on molding sand, I have read and reread all five of the splendid articles under the general heading "Sand Symposium." Something tells me I'll be reading these articles over and over again for some years to come, besides referring to them from time to time on troubleshooting expeditions.

Basic Laws Apply—I counted 59 curves, charts, and illustrations, representing the results of research, just as authentic and scientific as any of those involved in outer space investigation or exploration. And the amazing thing to me is that basic physical laws are common to both. I'll have to admit, however, as an amateur foundryman, that some of the so-called scientific terms used are somewhat confusing. Give me time, however, and I think

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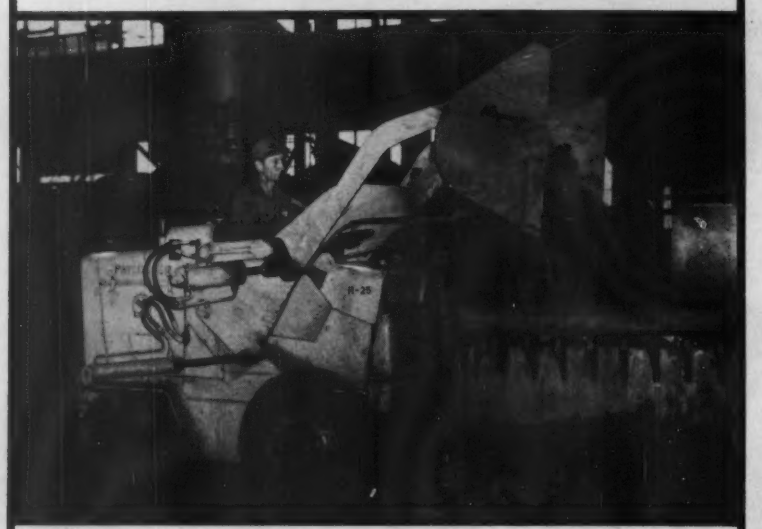

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Here's what users say about the Model H-25:

Power and Capacity—"We tried an H-25 'PAYLOADER' and it gave us the productivity and economies without having to install conveyors and other costly material handling equipment." . . . "Before purchasing the H-25 we had competitive demonstrations that proved its production efficiency over other machines."

Speed and Maneuverability — The H-25 "is doing a top production job. Power-steer and power-shift combination gives us maximum efficiency from both machine and operator." . . . "I find it fast and efficient. It has power to get the job done quickly and is easy on the operator."

Easy Operating — "Power steering and no clutch is a must. You can get full loads without spinning wheels and the operator lasts longer too." . . . "I like the maneuverability and work capacity."

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that I'll manage to get used to them.

There is no question that I have learned a number of new things as a result of my study of the Sand Symposium series, but the big thing to me is that I have found verification of what I already have learned through cut-and-try experience over the years.

In other words, even though I can't spew forth chemical, physical, academic, high-falutin' lingo, I find that I too, throughout the years, have been carrying on research projects just as authentic and just as scientific as they would have been had I known the proper words. If this were not the case, my findings through practical experience would not check as closely as they do with those resulting from laboratory experience.

In my opinion, any foundryman who has gotten onto the trick of doing his job from day to day and turning out good castings has had to be a scientist, even though he does not speak the so-called scientific language. Being a scientist, he has a right to hold his head up in spite of not knowing the signs, words, and phrases invented by those gathering and tabulating the very same data he uses.

A New Ritual—Some wise man said, "There are some who think that because they know the proper name of something, they understand it." What I'm afraid of is that there is getting to be a cult of name coiners who have set up a ritual of chanting technology, science, electronics, research with the implication that what is being done under these names has never been done before.

Maybe I have taken too long to get around to it, but I say that foundrymen need not crawl under a rock when learned people speak in a foreign language about the things they know inside and out. Neither should they shut themselves off from the findings of our splendid research activities. Either get an interpreter or take a few lessons in the language. But in any event, keep your heads up and your chests out.

In spite of all the regimentation, the individual still is indispensable, whether in research or in production, regardless of the language he speaks.

To a foundryman who wants to stay COMPETITIVE:

We'd like to help you.

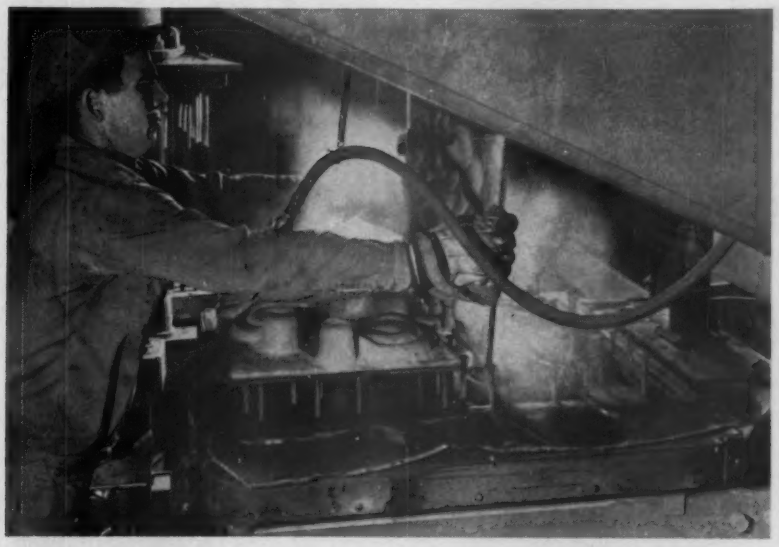
You've spotted the trend. You've observed that customers are getting more demanding. That quality standards are heading higher. That competition is growing tougher.

You're aware that service, always important, is becoming more important than ever.

And you've decided that these facts spell opportunity—for the foundry that can adapt to them and make the most of them.

Shell molds and shell cores fit into this growth picture. We'd like to help you make the most of the business opportunities inherent in the shell process. There's a complete line of Durez® foundry resins to give you the results you want—consistently.

Just as important, there's a Durez man nearby who can help you use these resins to best advantage in your foundry. He talks your language. He wants to see you grow. Why not drop us a line today, and we'll have him pay you a visit.



STREAMLINE PRODUCTION of molds and cores. Modern shell-molding machines can produce a high-quality mold every 30 seconds. Shell cores let you get rid of wires, forget about core driers; save you a long baking cycle. Good collapsibility cuts shakeout time on intricate castings.

SAVE ON STORAGE SPACE—yet have plenty of molds and cores ready for rush orders. They're simple to store and there's very little risk of breakage. How much space could *you* save by stacking big cores like this?

DO LESS MACHINING (perhaps none at all) on castings that must meet close-tolerance specs. Get smooth bores in valves, engine blocks, pump parts—without grinding. Reduce the customer's machining cost by producing smooth, sand-free surfaces that machine faster, let tools last longer.

CUT HANDLING IN HALF or better. Shell molds and cores are light to lift, easy to handle. No hoist is needed even for a core this big.

DUREZ PLASTICS DIVISION

HOOKER CHEMICAL CORPORATION, 1011 WALCK ROAD, NORTH TONAWANDA, N.Y.

HOOKER CHEMICALS PLASTICS

For More Information Circle 638, Page 39

Left to right, Ashley Sinnett, American Foundrymen's Society; Robert B. Fischer, Ingersoll-Rand Co., conference chairman; and John P. O'Neill, Malcolm Foundry Co., in charge of arrangements

Photos by Walter V. Napp

Record Crowd Attends

East Coast Conference

By JACK C. MISKE
Associate Editor

● A RECORD CROWD of more than 400 persons attended the East Coast Regional Foundry Conference, held Sept. 22-23, at the Statler-Hilton Hotel, New York. The program included 31 papers presented at five simultaneous sessions throughout the meeting. Areas covered included steel, gray and ductile irons, aluminum and magnesium, brass and bronze, and malleable iron.

STEEL

High-Strength Steel Castings, by R. J. Ely, American Brake Shoe Co. —Major defects in steel castings—including shrinkage, hot tearing, section size effects, and surface finish problems—can be minimized or eliminated by use of appropriate physical and process metallurgical factors. Thermal characteristics of molds, purity of metal, and adequate feeding are important. Care devoted to achieving good surface finish should be related to the amount of machining necessitated by gates, risers, and pads. (For more details, see "Achieving Ultra-High Strength in Low-Alloy Steel Castings," FOUNDRY, November, 1959, p. 90.)

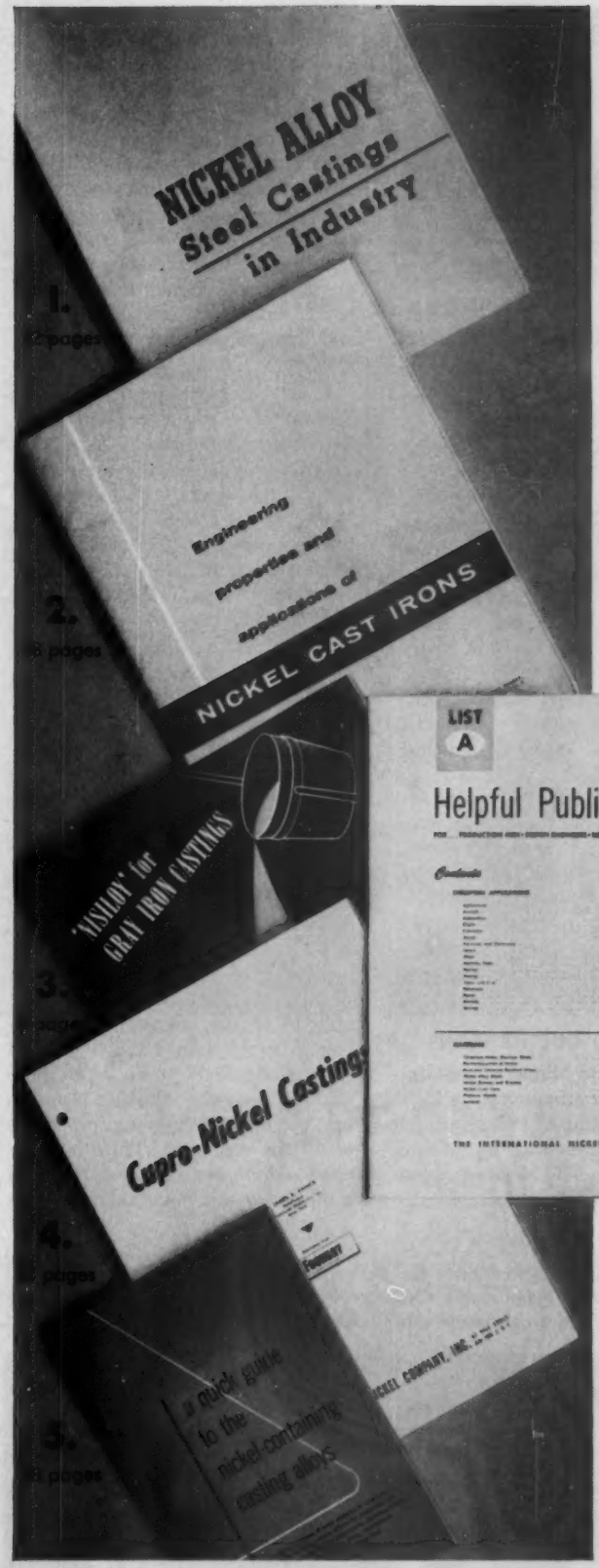
Solidification Studies on Steel Castings, by Merton C. Flemings, Massachusetts Institute of Technology—Recent MIT research on low-alloy steel castings indicates that microporosity strongly affects ductility of such castings at high strength levels. Microporosity can be reduced by vacuum melting followed by pouring under an inert atmosphere or even under air. Pressure helps the metal feed between dendrites during solidification.

Sulfur content is important, and properties rise to as high as 300,000 psi tensile strength when sulfur is sufficiently low and the casting process is under control. Microsegregation—minute segregation of particles—also holds down properties. Other important factors include feeding distance, thermal gradients, and directional solidification.

Press Forging of High-Alloy Steel Castings, by Tom Watmough, J. T. Berry, and P. R. Gouwens, Armour Research Foundation, Illinois Institute of Technology (presented by Mr. Watmough)—Press forging of 18-8 stainless steel, 17-4 precipitation hardening stainless steel, and SAE 4340 steel sand castings under controlled conditions of temperature and deformation results in considerable increases in strength under ideal conditions. Most suitable alloys for the technique are low-carbon, high-alloy types of steel in which the martensite can sustain deformation. The 18-8 steel, which deformed 30 per cent at −100° F, gave the most encouraging results.

AFS Progress Report Sponsored by the AFS Steel Division, by R. A. Flinn, L. H. VanVlack, and associates, University of Michigan (presented by G. A. Colligan, United Aircraft Corp.)—Nonmetallic inclusions—called snotters, ceroxides, etc. —in steel castings consist in their most serious form of corundum crys-

Program chairmen were, left to right, Donald LaVelle, aluminum and magnesium; David Tamor, malleable iron; G. F. Hyde, gray and ductile irons; R. F. Schmidt, brass and bronze; and W. A. Koppi, steel



Which of these 6 valuable Inco publications can help you?

There is probably more information about Nickel in Inco publications than in all the encyclopedias and text books of the world.

This material has been accumulated gradually through the 40 years that Inco has carried on its extensive Research and Development program.

Notice the six pieces of literature shown at the left. Five of them deal specifically with your interest—the production or utilization of quality castings by industry. All five contain helpful technical data presented in an easy-to-read style.

And the sixth? It includes a detailed listing of the many more publications available to you—plus a handy postage-paid request form for the literature of your choice. Just mail the coupon below for any of the publications you'd like to have.

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INCO NICKEL

NICKEL MAKES CASTINGS PERFORM BETTER LONGER

Registration and reception committee included, left to right, Sandi Summers, James Davis, John Wheland, John G. Steinebach, H. A. Patterson, and Joan Perrin

tals in a glassy silicate groundmass. This material can be formed during deoxidation of the steel, by reaction with ladle refractories, and in the mold itself, but reaction with ladle refractories is the most serious source. Such inclusions can be eliminated by the use of alumina or magnesia refractories and by a whirl gate trapping system.

Silica and fire clay refractories are subject to fluxing reactions at manganese levels over 2.75 per cent. Manganese does not produce corundum, however, unless aluminum is added to the steel. Time of contact is important, particularly at high manganese levels.

A Technical Review of the 28th International Foundry Conference, Vienna, Austria, June 18-24, 1961, by A. J. Kiesler, General Electric Co.—For similar reviews of papers presented at the 1961 International Foundry Congress, see FOUNDRY, September, 1961, p. 157, and October, 1961, p. 201.

Specialty Melting as a Service Function in a Research Laboratory, by W. F. Moore, General Electric Co.—Specialty laboratory furnaces include the consumable electrode, inert electrode, zone refining, and atomic hydrogen types. Choice of one for a given project should be on the basis of the melting point, purity, and reactivity of the metal involved. Refractories should be chosen on a similar basis—particularly melting point. Over-all, these questions are important in the choice of a melting process: 1. Pure metal or alloy. 2. Melting point. 3. Phase diagram information. 4. Vapor pressure. 5. Reactivity of constituents. 6. Purity desired. 7. Density. 8. Available raw materials (form and purity). 9. Shape of product. 10. Maximum allowable cost.

Metallurgical Theory + Mathematical Models + Industrial Data + Computers = Highest Quality, Low Cost Steel Castings, by John Zotos, Northeastern University—Metallurgical theories are employed to provide full understanding of the role of alloying elements in liquid and solid steel systems and to aid in the formulation of mathematical models. The significance of these models in production steelmaking environments is evaluated statistically with a computer by substituting and testing real data generated under industrial conditions. Results of investigations are further evaluated to determine how the mathematical models they have generated can be used fully to produce the highest quality steel castings in the shortest processing time, thus reducing their cost.

GRAY AND DUCTILE IRONS

Education and Management—Improvement in the Foundry, by H. F. Taylor, Massachusetts Institute of Technology (presented by Merton C. Flemings, MIT)—More than one-half of all foundries have no salesmen and do little to promote castings with potential users. In Europe, design engineers are taught the value of casting design, and, as a result, European foundrymen can compete better with wrought metals. European foundries usually have a backlog of a full year's work. Most new foundry developments in the last 10 years have come from Europe. The foundry industry needs to interest management-minded young engineers and businessmen and then to use their talents effectively.

Engineering Properties of the Various Cast Irons, by Vernon H. Patterson, Vanadium Corp. of America—Differences in the properties of the various cast irons are caused by the manner in which carbon is present and by their matrix structures. Significant properties of gray iron include excellent castability, good machinability, good wear resistance, high damping capacities, high compressive strength, good tensile strength, and variable modulus of elasticity. White cast iron is valuable as an engineering material when high hardness coupled with high compressive strength is important.

Malleable iron, available in either ferritic or pearlitic form, can be obtained in tensile strengths from 50,000 to more than 110,000 psi, with 2 to 25 per cent elongation, depending on strength and hardness. Ductile or nodular iron is available in tensile strengths from 60,000 to more than 120,000 psi and with elongations from 2 to more than 20 per cent. Alloying elements are useful in modifying properties of all the cast irons. Their use permits significant improvements in mechanical and physical properties

Chairmen of sponsoring chapters for the conference included, left to right, K. H. Kostenbader, Philadelphia Chapter; R. V. Hunter, Metropolitan Chapter; and George D'Andrea, Chesapeake Chapter

Soil pipe is cast in this Jeffrey-built automatic centrifugal casting machine which is part of the complete soil pipe producing package unit, engineered and installed at Salem. Inset illustration shows apron conveyor operating from casting machine to shakeout.

"Layout best...no better equipment," says Salem about Jeffrey turnkey job

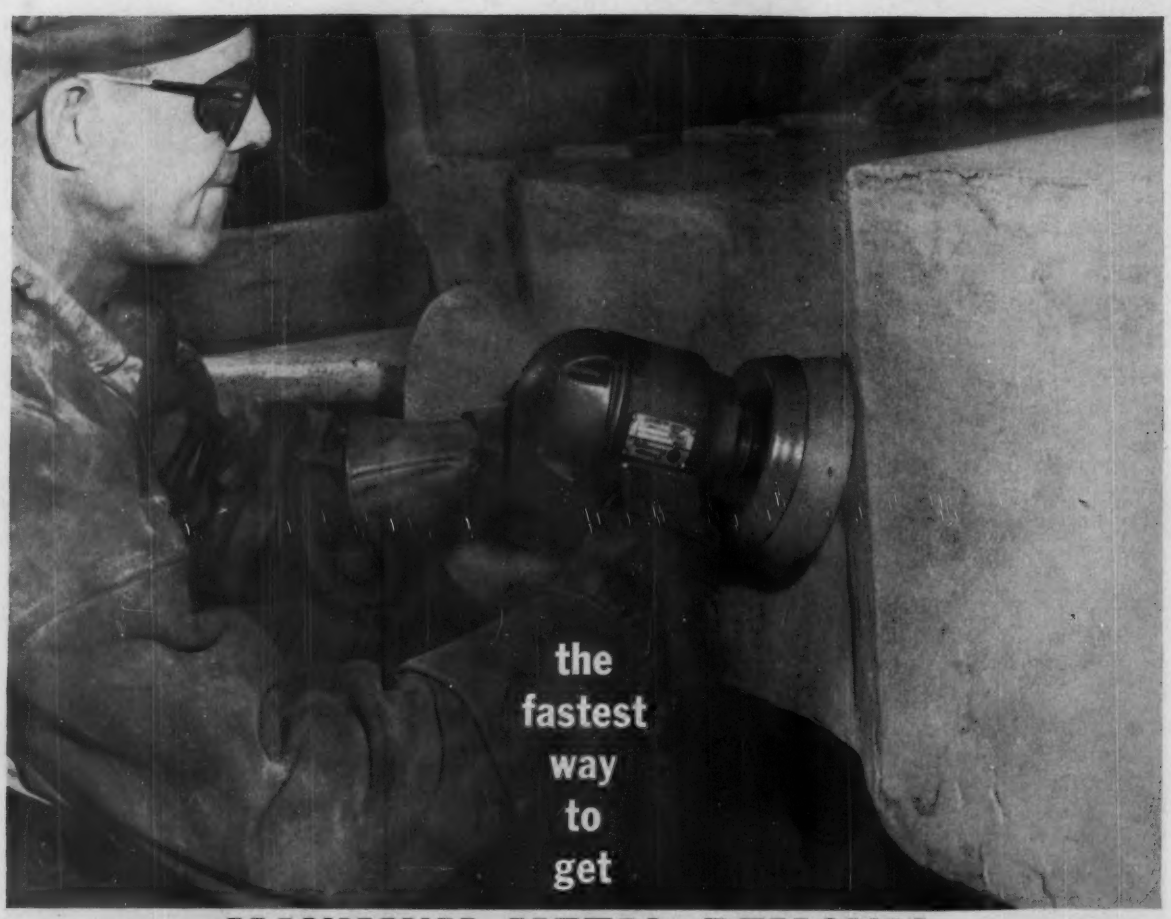
The pictures on this page show a new, complete soil pipe producing unit engineered and installed by Jeffrey for Salem Pipe & Iron Manufacturing Company at its highly mechanized, modern soil pipe foundry in Bridgeton, New Jersey.

Here's what J. A. Lasater, General Manager, has to say about the job: "Our system we believe to be excellent. Our layout is probably the best in the industry. The equipment is typical of Jeffrey's high standards and we know of none better."

When it comes to service, here's what was said about the Jeffrey installation man on the job: "We consider it a privilege and a pleasure to work with him. We found him always helpful and cooperative ... fair and open-minded, but at the same time leaving little doubt he was a Jeffrey man."

Jeffrey equipment and engineering knowledge can help solve your problems, too. It will pay you in satisfaction and future profits to give your nearest Jeffrey office a call when you consider changes in your foundry. Or write The Jeffrey Manufacturing Company, 907 North Fourth St., Columbus 16, Ohio.

If it's conveyed, processed or mined, it's a job for Jeffrey. JEFFREY



MAXIMUM METAL REMOVAL...

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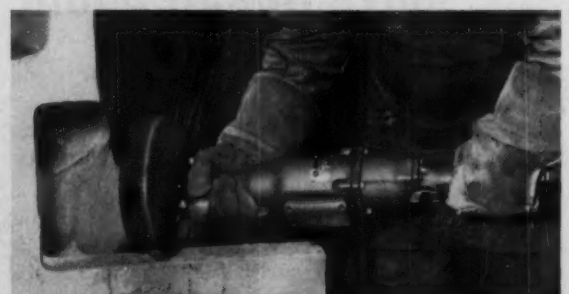
No matter what metal removal problem you have, you'll find there's a CP air-tool that's exactly right to handle it easily. Tremendous reserve power in CP Grinders minimizes speed sag under heavy load. These light-weight, easy to handle grinders, chippers and polishers keep your metal removal costs low and your production records high.

Choose your casting clean-up tools from CP's wide selection of foundry-proved equipment: Vertical or Straight Grinders . . . Die Grinders . . . Small Wheel Grinders . . . Wire Brush Machines . . . Chippers and Scalers.

Write for full details: *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

CP SIMPLATE CHIPPER, powered for hard hitting, but smooth-throttled for easy handling . . . a real producer in any shop.



CP-3301 STRAIGHT GRINDER, with exclusive new exhaust system which reduces noise level energy by 50%. Safe, steady, silent.

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and in resistance to corrosion.

Influence of Inoculation on the Structure of Gray Cast Iron at Various Equivalences—Progress of Solidification in Inoculated and Uninoculated Gray Iron, by Harish D. Merchant, Owens-Illinois Glass Co.—Additions of calcium and aluminum-bearing ferrosilicon to irons of various compositions greatly decrease eutectic cell size of low-carbon-equivalent irons. Reduction decreases with increasing carbon equivalence. Effective inoculation with ferrosilicon always produces Type A graphite. Thermal and microscopic studies on inoculated and uninoculated irons of about 4.0 carbon equivalence show that the eutectic solidification temperature range occurs at higher temperatures in the uninoculated irons. Thermal gradients across the casting section are slightly shallower during the eutectic solidification of the inoculated irons.

Post Inoculation of Ductile Iron, by Warren C. Jeffrey, McWane Cast Iron Pipe Co.—Investigation showed that the best physical properties, including impact resistance, are obtained in ductile iron by post inoculation with ferrosilicon containing calcium and magnesium. In the study, the iron was treated with pure magnesium introduced with a graphite plunger. The iron was at 2800° F in 100-lb ladles. Reaction required 75 seconds to start and was completed 150 seconds later. Post inoculation was accomplished by pouring the treated iron over the ferrosilicon in another ladle. Iron should be poured within 3 to 6 minutes after inoculation.

Shop Use of Calcium Carbide in Acid Cupolas, by Ralph Clark, Union Carbide Metals Co.—Properties and application of a new exothermic material, EM foundry carbide, were described in detail in October FOUNDRY, p. 141. The material is used to increase metal temperature in cupola operation.

Shop Course on Ductile Iron Production, by Harold Ruf, Grede Foundries Inc.; E. A. Welander, John Deere & Co., and J. F. Coursey, Koppers Co.—Ductile iron is a good material but close controls are necessary in its production. About 90 per cent of all ductile iron is melted in cupolas. Most of the tonnage comes from basic cupolas, although the majority of operators used acid cupolas because the furnaces also are used to produce other types of iron. Each type has advantages and disadvantages compared with the other. Most foundries add magnesium by placing it in the ladle before tapping the cupola, although it is the least effective method for magnesium recovery.

An effective method of determining graphite formation in as-cast ductile iron is the simultaneous casting of a so-called micro-lug. The piece is polished and inspected by microscope.

BRASS AND BRONZE

AFS Brass and Bronze Research at the University of Michigan, by R. W. Ruddle, Foseco Inc.—Early work for the AFS Brass and Bronze Research Committee at the University of Michigan led to development of a test bar casting in which thermal gradients during freezing were measured. Thin sections cut from the bar at various locations were pressure tested to assess soundness.

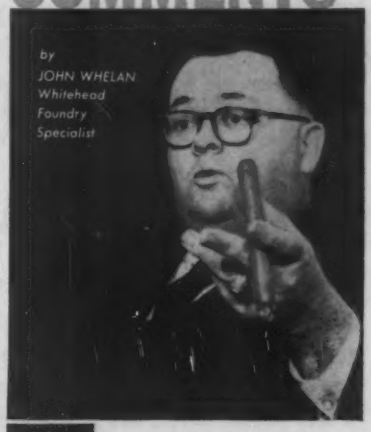
A detailed study was made of the freezing soundness and mechanical properties of red brass under various conditions. Pouring temperature, chilling, and other factors are variables which affect results.

The most recent work of the Brass and Bronze Research Committee is an extension of a study made with the bar casting to other copper-base alloys, including 80-10-10, 88-8-4, aluminum bronze, manganese bronze, silicon brass, and nickel silver.

What's Wrong with Copper Alloy Castings?, by Herbert F. Scobie, Non-Ferrous Founders' Society—Producers of materials competitive with castings consistently attempt to downgrade castings to customers. The only effective answer to such efforts is to use quality control to make better castings at lower costs. Quality has to be built into a casting; it can't be inspected in. In addition, foundries need to do a more intelligent job of selling. The day when castings were bought more often than they were sold is gone for good. An NFFS survey indicates, in order of importance, these reasons why castings are used: 1. Quality. 2. Service. 3. Price.

New Developments in Melting, by H. F. Gauker, Ajax Magnethermic Corp.—The induction electric

CASTING COMMENTS



NICKEL FACTS NOT IN "THE BOOK"

If every foundryman went "by the book", one would be as good as another—and you know that just ain't so. It's the know-how that is gathered from here and there that makes one man better than another.

For example: "the book" is very explicit on the purpose and advantages of nickel in carbon steel castings. But, "the book" doesn't give the other advantages of adding nickel in the form of Inco Electrolytic Nickel. And there are several positive advantages, including:

1) Inco Electrolytic Nickel can be added to the molten steel at any stage of the melting practice.
2) Inco Electrolytic Nickel is fully recovered. There is no melting loss.
3) It is pure nickel, free from harmful impurities and gases that can create casting problems.

Needless to say, we maintain a good stock of Inco Electrolytic Nickel on hand for prompt delivery. Want more details? Give me a call.

WHITEHEAD METALS

Casting Comments by other Whitehead Foundry Specialists appear elsewhere in this issue. Look for them.

WHITEHEAD METALS, INC.
303 West 10th St., New York 14, N.Y.

For More Information Circle 642, Page 39

BELT LIFE TRIPLED WITH 3M ABRASIVE

Union Brass and Metal Mfg. Co., St. Paul, Minn., switched to "Tri-M-ite" Resinbond Cloth Belts for grinding brass plumbing castings prior to plating. The results were remarkable. Belt life was boosted 3 times; a finer scratch pattern was achieved to speed final buffing and plating operations; and overall abrasive costs were reduced 10%!

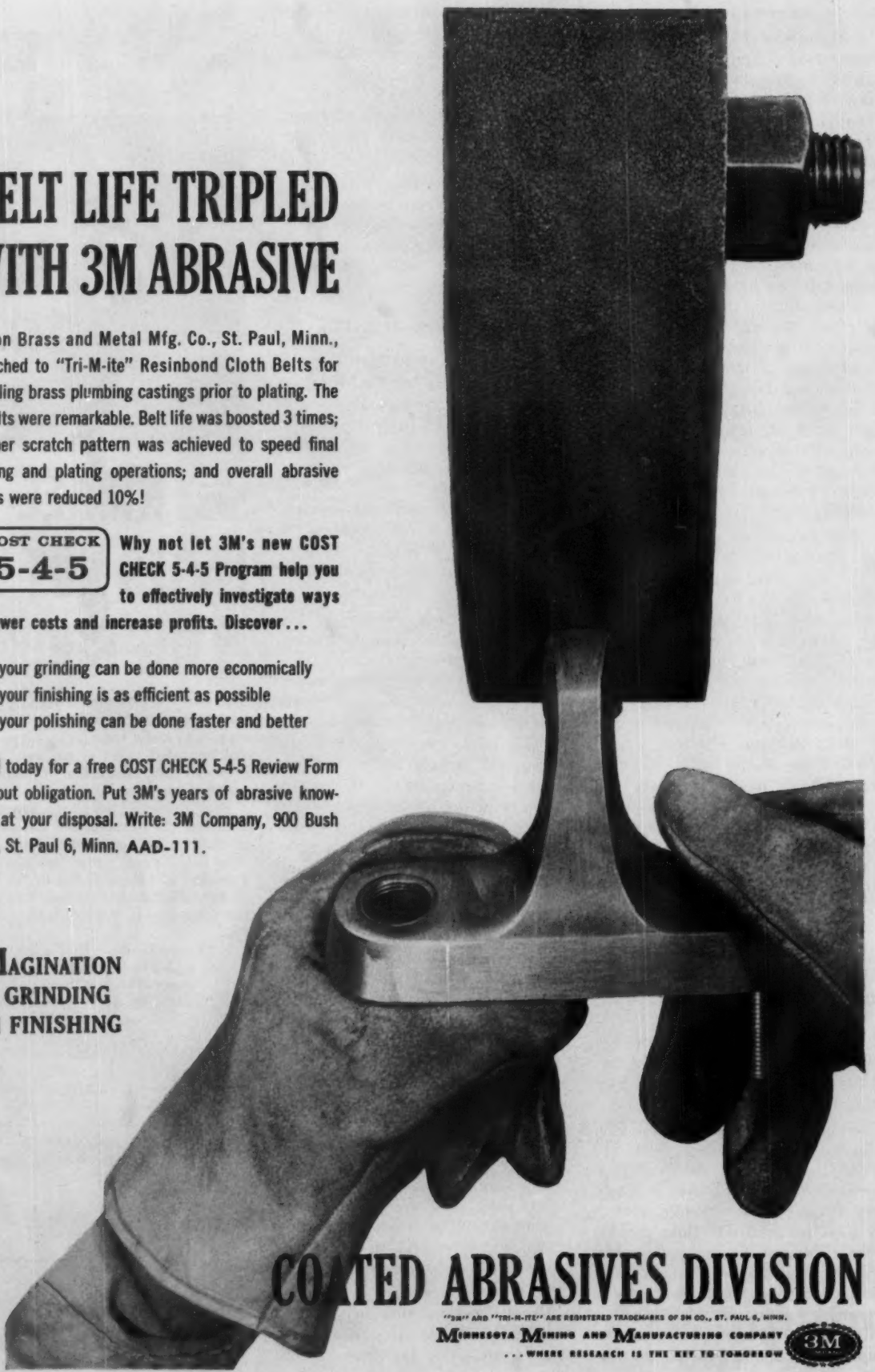
COST CHECK 5-4-5

Why not let 3M's new COST CHECK 5-4-5 Program help you to effectively investigate ways to lower costs and increase profits. Discover...

- If your grinding can be done more economically
- If your finishing is as efficient as possible
- If your polishing can be done faster and better

Send today for a free COST CHECK 5-4-5 Review Form without obligation. Put 3M's years of abrasive know-how at your disposal. Write: 3M Company, 900 Bush Ave., St. Paul 6, Minn. AAD-111.

3MAGINATION in GRINDING and FINISHING



COATED ABRASIVES DIVISION

"3M" AND "TRI-M-ITE" ARE REGISTERED TRADEMARKS OF 3M CO., ST. PAUL 6, MINN.

MINNESOTA MINING AND MANUFACTURING COMPANY

...WHERE RESEARCH IS THE KEY TO TOMORROW

3M

furnace offers many advantages as a melting unit. It automatically stirs the molten metal and is ideal for alloying since it prevents segregation without agitation. Because it never is subject to extremely high temperatures, metal quality is not impaired. Analyses can be duplicated easily, and metal loss is low — under 1 per cent for 85-5-5-5 in a channel furnace with a charcoal or graphite cover, for example. In addition, these furnaces emit no waste gases, heat, or noise. The electromagnetic stirring inherently lowers gas content.

ALUMINUM AND MAGNESIUM

Superston, a New, High-Strength Aluminum Bronze, by Frank Herlihy, American Brake Shoe Co.—Superston is a patented British alloy with properties which make it extremely useful for many applications. Its melting point is 1740° F, and the analysis is 75 Cu, 8 Al, 3 Fe, 12 Mn, and 2 Ni. Properties include 98,000 psi tensile strength, 48,000 psi yield strength, and 26 per cent elongation.

Use of Multiphase Wetting Compound in Nonferrous Foundry Sand Practice, by William N. Richards, Deynor Corp.—For full details on this subject see FOUNDRY, March, 1961, p. 81.

Round Grain Carbon Sand — a New Molding Medium for Brass and Bronze, by E. G. Gentry, Humble Oil & Refining Co.—For a detailed discussion of this material, see FOUNDRY, June, 1961, p. 170.

Present Day Melting Equipment for Aluminum and Magnesium Alloys, by Ray P. Dunn, Lindberg-Fisher Div., Lindberg Engineering Co.—The bulk of Mr. Dunn's presentation consisted of a discussion of the various types of melting units available for aluminum and magnesium casting. Each was discussed in terms of its advantages and disadvantages and types of applications for which it is best suited.

Mr. Dunn also described methods of dealing with common casting problems related to melting. Hard spots, for example, usually are caused by oxides or sludge in the metal. Sludge formation is the result of segregation in the melt of such metals as iron, manganese, and chrome. Sludge hard spots are shiny, whereas oxides are gray or black. Fluxing usually helps in the production of clean metal, but it must be performed properly.

Degassing Aluminum with Nitrogen-Chlorine Mixtures, by John B. LaPota, National Cylinder Gas Co. (presented by Floyd W. Richards)—In the past, both chlorine and nitrogen have been used to degas aluminum. Chlorine has mechanical and chemical actions and is effective in most respects, but releases free chlorine, which is a health hazard. Nitrogen has only a mechanical action. A combination of the two gases provides the best features of either with no hazard. The nitrogen-chlorine mixture is 90 per cent or more nitrogen, 10 per cent or less chlorine. Both gases provide mechanical action, bubbling out hydrogen, and the chlorine acts chemically and is completely used up. Thus the chlorine is not wasted and presents no danger to employees. The gases are taken from separate tanks. They are mixed at a manual proportioner to which the nitrogen is delivered at 50 psi and the chlorine at 20 psi. Teflon-lined high pressure hose is used to resist attack by chlorine.

The Newest Magnesium Casting Alloys, by Richard Hauser, Eclipse-Pioneer Div., Bendix Corp.—Alloy QE22A provides good yield strength at room temperature and good tensile properties at temperatures up to 500° F. HK31A offers better properties at temperatures up to 700°F but it is sluggish and somewhat difficult to cast. The alloy's pouring temperature is critical, and a compromise in casting is necessary between bottom and top pouring. Various of these new alloys contain relatively expensive alloying elements and are used mainly by the aircraft industry.

Furan Resins and Aluminum Castings, by R. M. Ovestrud, Reichhold Chemicals Inc. — Mr. Ovestrud discussed the chemistry of the furan resins, with emphasis on the no-bake type, and described a number of typical aluminum casting applications in case history form.

Heat Treatment of Aluminum Casting Alloys, by E. E. Stonebrook, Aluminum Co. of America —Heat treatment of aluminum alloy castings achieves improved and specific combinations of mechanical properties. It also can improve dimensional stability, particularly at elevated temperatures, although at

CASTING COMMENTS

WHAT DO YOU KNOW ABOUT DUCTILE IRON?

You know that ductile iron is made by transforming the graphite from flake to spheroidal form. You know that this is done by the introduction of magnesium. And, you know that this results in higher strength, and tougher castings.

But, did you know that nickel is the most efficient carrier used in commercial practice for the introduction of magnesium into molten iron? For this reason, we recommend Inco's Ductile Iron Additives. There are other good reasons, too.

You get the highest magnesium recovery of all commercial alloys. You are able to stay below your maximum specified silicon content. It's suitable for treating irons produced in all melting units including acid lined types. And, it produces an iron with the best and most uniform response to heat treatment.

Best reason of all, it's available from our warehouse stocks.

Call me if you'd like more information on this or any of the more than 100 alloys we handle.

WHITEHEAD METALS

Casting Comments by other Whitehead Foundry Specialists appear elsewhere in this issue. Look for them.

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For More Information Circle 644, Page 39

New ROTOBLAST saves labor cost of seven men

Cost-cutting Rotoblast knocks out heavy core sand and rods, above, in large castings at Elyria Foundry. Inset: cleaned castings are moved to next operation while second table-load is being Rotoblasted.

One man and one new ROTOBLAST twin table room do the same amount of blast cleaning work *better* than eight men did with previous blast equipment at Elyria Foundry Division, Chromalloy Corporation, Elyria, Ohio. Among extra benefits: new high capacity abrasive separation (equipment on core-knockout ROTOBLASTS) handles core removal right along with blast cleaning, removing a ton of sand an hour from spent abrasive.

Whatever your cleaning needs, a standard or specially designed Rotoblast unit can cut your manpower and operating costs. Full automation can be built in. Easy installation, simple maintenance and fast, thorough cleaning are regular features of Rotoblast.

TRY ROTOBLAST ABRASIVES, TOO!

You can clean castings faster — at lower cost per ton — with solid, tough Rotoblast Steel Shot and Grit. No wonder! The development of this modern abrasive by Pangborn is based on nearly 60 years' experience supplying industry's blast cleaning needs. We'll be glad to go into more detail. Just write:

PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Md.; Pangborn Canada, Ltd., 47 Shaft Rd., Toronto (Rexdale), Canada; or phone district office in Yellow Pages under "Sand Blast Equipment." *Manufacturers of Blast Cleaning, Vibratory Finishing, Dust and Fume Control Equipment—Rotoblast® Steel Shot and Grit®.*

Operation ROTOBLASTING

(BEST IN BLAST CLEANING)

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some sacrifice in mechanical properties.

Solution, or −T4, heat treatment involves heating of castings for 8-12 hr at a temperature just below the melting point, then quenching them rapidly in water at 150-212° F. This treatment increases tensile strength and elongation and may increase yield strength.

After −T4 treatment, alloy constituent or compound usually is precipitated from solid solution in very finely divided form in adjusting to equilibrium. This process can be speeded up by heating or aging for several hours at about 300 to 500° F. The lower temperatures produce a −T6 heat treatment and the higher temperatures a −T7 treatment.

The −T6 treatment increases strength and hardness appreciably at a sacrifice in ductility, and the −T7 treatment produces coarser precipitate and somewhat lower properties, but improves dimensional stability. Similar aging treatments of as-cast material, referred to as −T5, have appreciably less effect on mechanical properties than −T6 or −T7 treatments.

Aluminum Permanent Mold Practice, by D. L. LaVelle, American Smelting & Refining Co.—Permanent mold practice still is largely an art which requires skill gained through experience. The most common mold material is gray iron, which must be cast sound to provide good thermal characteristics and long life. Cast steel sometimes is used to give longer mold life, but is more expensive. Mold thickness ranges from ¾ to 2 in., but usually is 1 to 1¼ in. Best practice calls for constant mold temperature once cycling is achieved. Rangy castings call for thinner molds, and chunky castings for thicker molds. Mold temperatures usually range from 550 to 750° F. Mold coating is extremely important.

Gating varies, but gate and sprue should be designed so that they can be poured easily and that pouring is not a variable. A tilt from the vertical on the runners prevents the free fall of aluminum and avoids dross caused by agitation. A well at the bottom of the runners is helpful, and web gating is desirable. Side risers should be connected to the top riser, and gating should be into the risers.

MALLEABLE IRON

Recent Developments in Malleable Iron, by Norman Birch, Albion Malleable Iron Co.—New applications for malleable iron still exist, as exemplified by Albion Malleable's recent development of cast pearlitic malleable shells (see FOUNDRY, September, 1961, p. 104) and of a sulfur-stabilized nodular malleable it has named Spher-a-Steel. Malleable founders should use available data on machinability of malleable and its ability to be cast straight, then shaped under impact for use instead of a forging. Many punching, coining, and swaging operations can be performed easily and used as sales points.

In another new development, Jamestown Malleable Iron Co. is making a ductile malleable by injecting pure magnesium in base mallable and is obtaining good elongation and reduced heat treatment. Work on as-cast malleable still is being done, but without solid results to date.

Pearlitic Malleable Iron and Its Applications, by Prof. Richard Schneidewind, University of Michigan—The class of irons such as malleable, pearlitic malleable, and nodular are produced in various grades of quality. The better grades—higher yield strengths at a given elongation level—can be achieved by judicious alloying with a carbide stabilizer such as molybdenum or manganese. It is probable that more research in the annealing cycles could bring about greater uniformity of properties and consistently higher quality.

Specifications have been written so that the poorest foundry conditions can produce them. By careful annealing and heat treatment, higher quality irons can be made consistently. The market cannot be opened unless foundries have a product and a higher specification to cover it.

Laboratory Control in a Mallable Shop, by Gordon B. Mannweiler, Alloy Foundries Div., Eastern Co.—A malleable control laboratory has three main functions: 1. Control over melting and heat treating processes. 2. Keeping informed on new or pending specifications or modifications to specifications pertinent to malleable iron production. 3. Investigation and testing. Specific

* "JUGGLING" FOR HIGHER TENSILE CAST IRONS

Did you know that 2 base irons can produce selected tensile strengths from 30,000 to 60,000 PSI just by the proper "juggling" of small amounts of alloying elements.

Take a look at these figures:

3.25% T.C.-2.25% Si Iron has a tensile strength of 30,000 PSI. Adding only 0.75% Ni and 0.30% Cr increases the tensile strength to 35,000. 1.50% Ni-0.60% Cr to 40,000; 1.50% Ni, 0.30% Cr, 0.30% Mo to 45,000; 2.00% Ni, 0.60% Mo to 50,000.

Similarly, the tensile strength of 3.00% T.C. −2.00% Si Iron zooms from 35,000 to 60,000 PSI with properly selected alloys and quantities.

And, higher tensiles are just part of the benefits, you also get greater wear resistance, uniform hardness throughout light and heavy sections, better corrosion resistance and improved resistance to thermal shock and general heat effects.

Let me know if you would like to discuss this alloying procedure further.

Casting Comments by other Whitehead Foundry Specialists appear elsewhere in this issue. Look for them.

WHITEHEAD METALS, INC.
303 West 10th St., New York 14, N.Y.

CASTING * COMMENTS

by JOHN JENNINGS Whitehead Foundry Specialist

For More Information Circle 646, Page 39

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operations can be classified under the headings Sand Testing, Chemical Analysis, Metallography, Mechanical Testing, Product Evaluation, Clerical Work, and Miscellaneous. Since a laboratory is an item of overhead, it must be operated efficiently to keep down costs, but it also must be equipped and staffed so that it can perform the job it is expected to do.

Good Cupola Operation as a Primary Need in Duplex Melting for Malleable Foundries, by W. R. Jaeschke, Whiting Corp. — Success of the duplexing system depends on the user's ability to obtain good control of cupola melting conditions. Control starts with the selection of the raw materials to be used. Coke should be strong, hard, dense, and slow-burning, usually from 1/10 to 1/12 the size of the cupola's inner diameter. All metallic materials should be sized to a maximum dimension of not more than one-third the unit's inside diameter, and neither too small nor too large.

The cupola should be of such a size that it is operated at or above its usual rated capacity and should be equipped with the best available accessory equipment to promote good control. The charge should be calculated carefully for each day's heat according to the actual analysis of the materials used that day. Careful calculation of the charge should be followed by accurate charge makeup.

Practical Applications of Pearlitic Malleable Iron, by Carl Joseph, Miller & Co.—One of the biggest advantages of pearlitic malleable castings over steel forgings is their machinability. Oil-quenched and tempered pearlitic malleable is about 18 per cent superior to air-quenched. Microstructure is more important than hardness. Today, every American car uses a pearlitic malleable universal joint yoke which saves 15 cents on machining as compared with a steel forging. In rocker arms, pearlitic eliminated the need for a 4 or 5-cent bronze bushing which was needed in the previous forging. Similarly, pearlitic malleable has achieved cost reductions or longer life for many other automotive parts, particularly crankshafts. In the latter it made possible easier machining, closer tolerances, and design flexibility, all with a cheaper material. There is a lot of pearlitic

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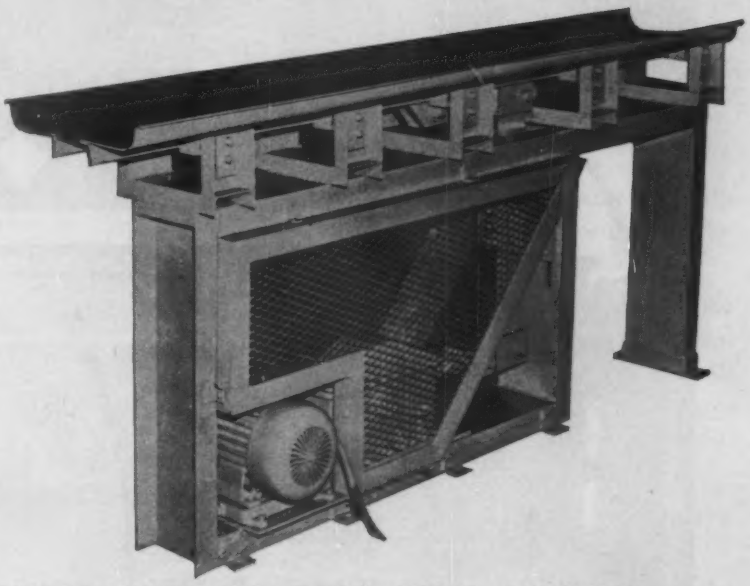

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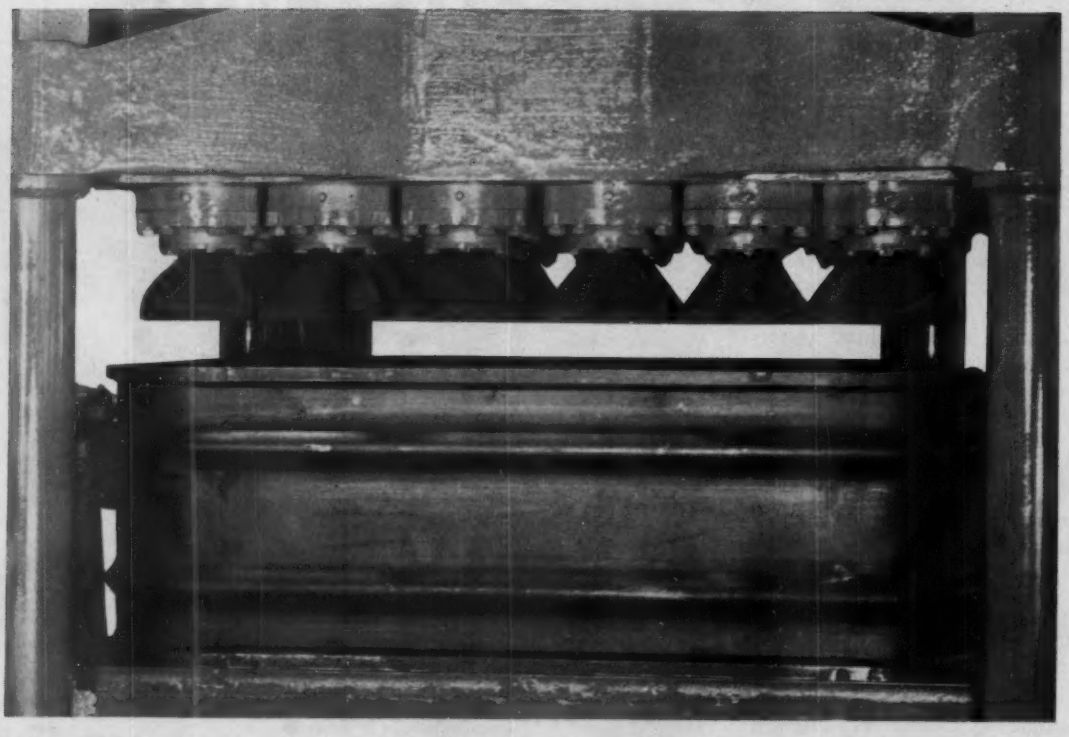
For More Information Circle 648, Page 39



The MOLDMASTER means

just what it says

THIS revolutionary Herman molding machine completely masters your molding requirements. Its engineering features are oriented to all normal foundry specifications, by a unique combination of:

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2. **Versatility**
3. **Efficiency**
4. **Simplicity**

The Moldmaster is a squeeze, strip machine designed to operate by automatic or semi-automatic controls.

Secret to perfect molds lies in the compacting of sand in proper relation to contour of the pattern. This is accomplished by the unusual principle of simultaneous, hydraulic, self-adjusting squeeze heads.

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The Moldmaster makes cope and drag molds or molds with two or more different types of patterns simultaneously.

Details concerning 20 different technical features are outlined in a brochure if you would like to investigate this Herman machine further . . . or one of our Sales Engineers isn't far away.

The Moldmaster is another example of Herman-engineered *cost reduction* equipment for foundries throughout the world.

Today is as good a time as any to check into this Herman machine, which is proving itself day after day in a wide variety of facilities.

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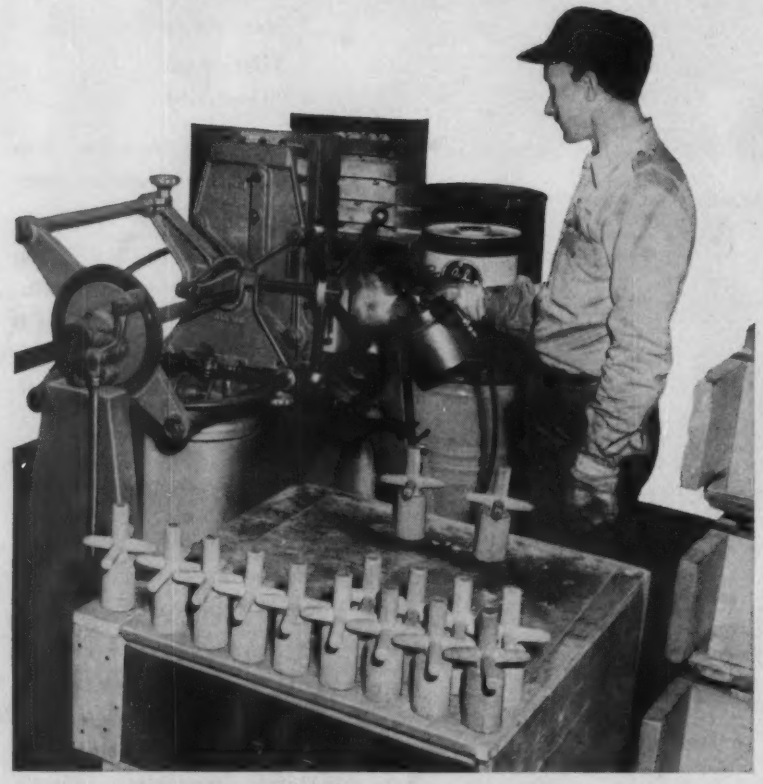
SILICONE RELEASE AGENTS FROM STEVENS PROVIDE

perfect separation of shell sands from hot patterns



New, improved G-E Silicone Release Agents from Stevens offer all of the important performance qualities required for the crisp, clean release of shell cores and molds from the hot metal pattern. They assure accurate reproduction of all contours and dimensions and detail, even on the most complex patterns.

Minimum Build-up—there's little or no build-up on pattern surfaces to destroy dimension accuracy.

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malleable business around for foundrymen willing to look for it.

Roundtable Discussion of Malleable Iron—The concluding meeting on malleable iron was devoted to a session at which everyone present discussed a far-ranging variety of questions pertaining to the industry.

Book Review

Principles of Manufacturing Materials and Processes, **by James S. Campbell Jr., cloth bound, 674 pages, 6 by 9 in., published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price $9.75.**

Textbook describes various manufacturing processes including casting, rolling, forging, welding, powder metallurgy, and machining. The "how" and "why" of each process is covered in detail.

Although the chapters covering foundry practice are likely to be considered elementary by the foundryman, the book is useful for its explanations of competitive metal shaping processes and for its discussions of machining castings. Chapters dealing with sand molding methods, inspection methods, and design of sand castings are included.

Perhaps the most interesting chapter is the one on measuring and gaging. This chapter covers tolerances, direct-measuring methods and instruments, indirect-measuring methods and instruments, and gages.

Altogether, seven chapters on machining are presented. Machining operations discussed include using the shaper, planer, and lathe; boring; milling; abrasive machining; sawing; broaching; and gear cutting.

Offers Report on Plant Rules

"Plant Rules in Foundries," published recently by the National Foundry Association, Bellwood, Ill., is a report on a survey of plant rules conducted by the association among its members. The report summarizes prevailing attitudes, most frequently used plant and safety rules, and different forms of disciplinary procedures. Several sets of rules are reproduced to reflect the various philosophies.

The report is offered to nonmembers for $2 a copy. Write to the association at 4321 St. Charles Rd., Bellwood, Ill.

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Your pneumatic system shapes up faster at the design stage when one man can discuss with you every component you'll need. But have you realized how much your Parker-Hannifin man can save you in money and air?

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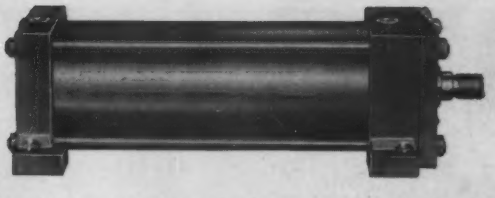
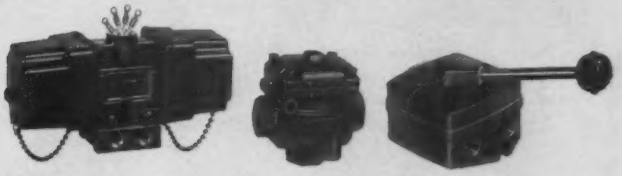


Low friction, long packing life are money-saving features of the Hannifin Series "A" pneumatic cylinder, available in a full range of mounting styles and from 1½" to 14" bore, strokes to 20 feet. Hannifin cylinder application data and charts make selecting the right Series "A" cylinder easy. Get yours from your Parker-Hannifin man.



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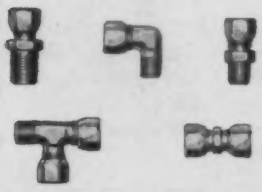
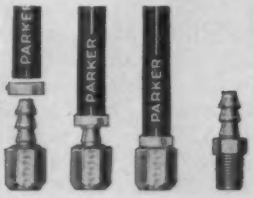
Use flow factors as money-savers—your Parker-Hannifin man can show you how. They help you to avoid "oversizing" your valves. Hannifin's new Valve Finder gives "Cv" ratings for every valve in the line, makes it possible for you to take full advantage of the extra air-flow capacity in Hannifin air valves. Get your copy today.



Pneumatic systems tube up fast with Parker "Intru-lok" tube fittings. Use them with copper, nylon or "Parker-POL" polyethylene tubing. Just insert the tube and tighten the nut for a leakproof "bite-type" joint.



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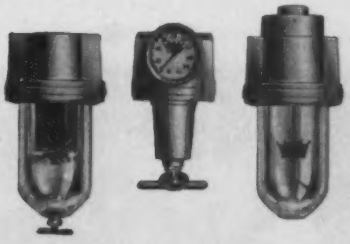
One air line connection installs the Hannifin Air Motor . . . an integral solenoid valve controlling a fast, rugged double-acting air cylinder. Built-in speed controls adjust piston speed in either or both directions.



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For More Information Circle 651, Page 39

Panel of speakers included, left to right, Harry S. Kindle, manager of quality control, Cummins Engine Co.; James W. Hallock, vice president and director of sales, Albion Malleable Iron Co.; John B. Caine, consultant; and Anthony E. Cascino, vice president of marketing, International Minerals & Chemical Corp.

MARKETING and ITS APPLICATION

Discussed at Cleveland Conference

● PROFITABLE application of marketing to the foundry industry was the theme of a conference held in Cleveland, Sept. 12, under sponsorship of the International Minerals & Chemical Corp. and Hickman, Williams & Co. Approximately 120 foundrymen of northeastern Ohio and western Pennsylvania attended.

Talks and group discussions were concerned with improving the methods by which castings can be sold in greater volume.

A four-member panel gave individual talks, after introductory remarks by J. M. Stewart, vice president, Hickman, Williams & Co., Pittsburgh, and Norman Dunbeck, vice president, International Minerals & Chemical Corp., Skokie, Ill. These presentations were followed by a question-and-answer period, after which individual group seminars were held with the four speakers.

Establishing the Market Concept—Anthony E. Cascino, vice president, marketing, International Minerals, indicated that the fundamental problems in selling castings are no different from those faced

Above, conference was attended by about 120 foundry executives from Ohio, Pennsylvania, New York, and West Virginia. *Below*, Mr. Cascino and Mr. Hallock conduct one of several seminars held during the meeting

OVER 425 FOUNDRIES* IN THE U.S. OWN AT LEAST ONE TO EIGHT DEPENDABLE SHELL CORE MACHINES

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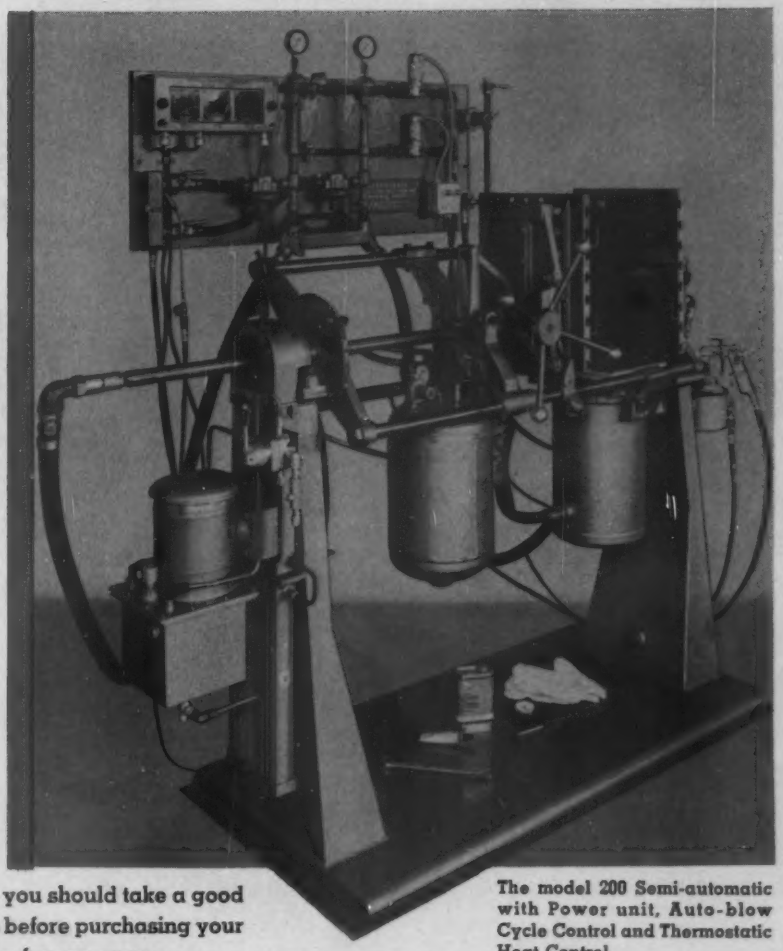

The model 200 Semi-automatic with Power unit, Auto-blow Cycle Control and Thermostatic Heat Control.

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CAPACITY: Available in models producing cores weighing one-half ounce to 230 lbs.

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RESULT: Dependable Shell Core Machines produce quality shell cores *at the lowest cost.*

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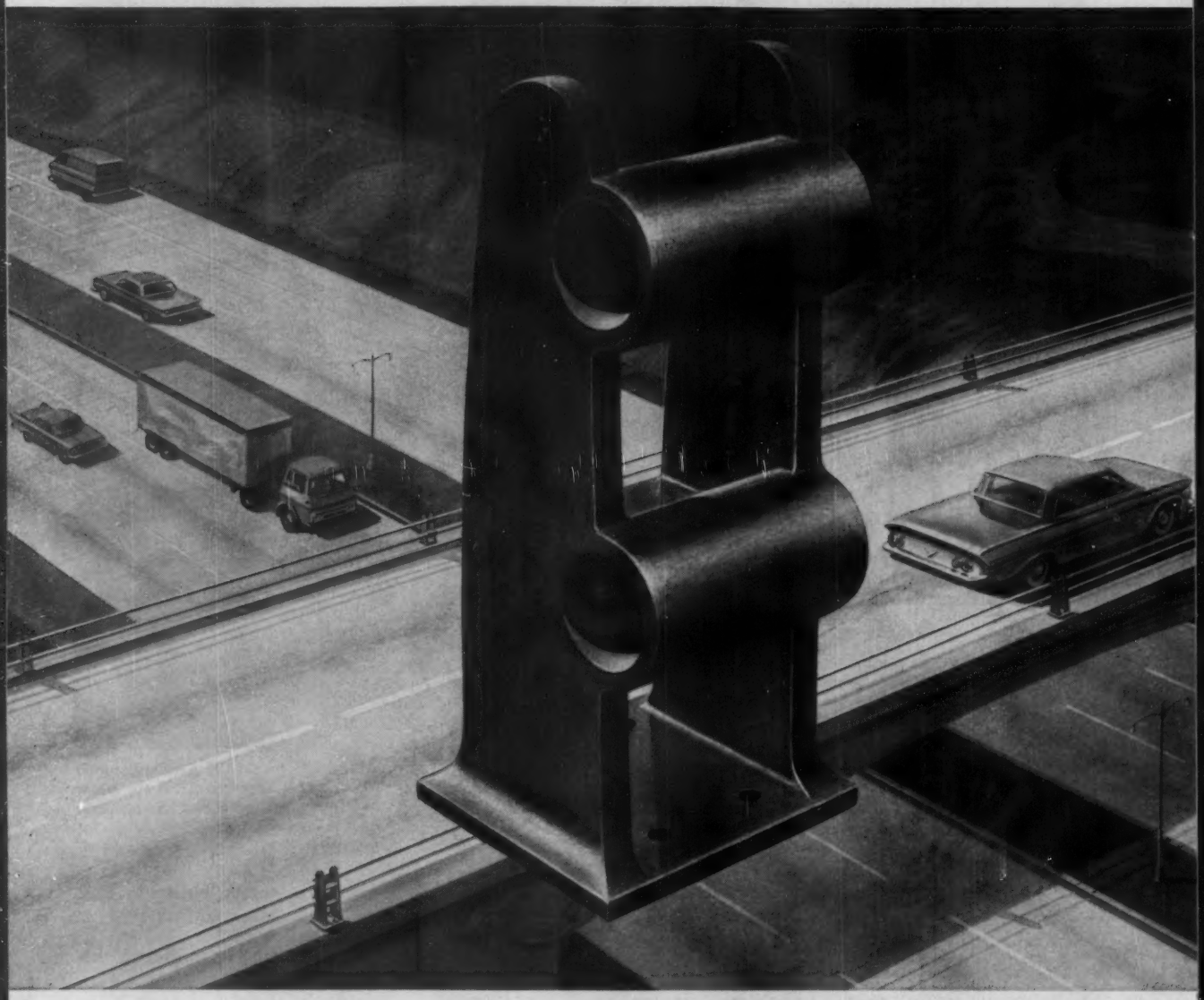
How the Foundry Industry Serves America . . . #13 of a Series



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This is just another example of how modern iron castings offer you superior benefits at substantial savings.

For the production of structurally sound iron castings, Hanna Furnace provides foundries with all regular grades of pig iron . . . foundry, malleable, Bessemer, intermediate low phosphorous, as well as HANNA-TITE® and Hanna Silvery.

Facts from the files of Malleable Founders Society

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For More Information Circle 653, Page 39

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and solved by other industries. Foundries must be customer conscious, and their whole marketing purpose must be to improve their customer's products. Unless your customer recognizes certain significant advantages that you possess as a supplier of castings, he usually seeks the lowest price—or another method of fabrication.

Selling Castings by Design—John B. Caine, foundry consultant, Cincinnati, pointed out how changes in a casting design can provide a more efficient, more economical, and more saleable product. (See FOUNDRY, June, 1961, p. 69 and January, 1959.) He also urged foundry salesmen to become acquainted with the engineers who specify the type of metal to be used in their products and to become active in technical societies.

Quality Control—A Sales Tool—H. S. Kindle Jr., manager, quality control, Cummins Engine Co., Columbus, Ind., stressed the need for increased attention of foundries to upgrading casting quality (see FOUNDRY, July, 1961, p. 62). He pointed out that final inspection is less important than the exercising of control over each step of the foundry process. Further, that the foundry's aim should be the attainment of a constant and low rate of scrap, rather than one which fluctuates widely and disrupts manufacturing schedules of the consumer.

Fiscal Responsibilities of Sales—James W. Hallock, vice president and director of sales, Albion Malleable Iron Co., Albion, Mich., emphasized that adequate return on invested capital is necessary for growth; moreover, a foundry is not being honest with its customers if it is a party, through inadequate cost knowledge, of eventually going out of business. The sales department also is responsible, of course, to the company and employees, for an intelligent pricing program based on known costs.

Building the Marketing Program—Summing up the conference, Wayne Brinkerhoff, Fuller, Smith & Ross, Cleveland, indicated the following as the major objectives for the individual foundry to establish in its marketing plan: Audience—who are the most important members?; product facts—which are the most important features of your product to stress?; market situation—in what features is your audience most interested?; competitive situation—which fields are most competitive?; sales objectives—what volume is desired?; communications—what is most important to tell the prospect?; budget—how much to spend?; communication — what methods to use?

Book Reviews

Decorative Cast Ironwork in Great Britain, **by Raymond Lister, cloth bound, 258 pages, 5½ by 8½ in., published by G. Bell and Sons Ltd., York House, Portugal St., London, England. Price 35 s.**

The author traces some of the history of his subject in the introductory chapter. He then moves on to technique, including up-to-date practices of patternmaking, molding, and melting. Many line drawings are used to illustrate various tools and pieces of equipment used in the foundry.

The chapters on the various types of ironwork are historical in nature, describing early iron founders in England and their contributions. In his discussion of the foundry worker, the author details conditions and wages prevalent in the craft up to the early 20th century.

A glossary lists ordinary foundry terms and those which are peculiar to the English foundry industry.

Zur Kenntnis der Passivierbarkeit und Korrosionsbestaendigkeit **technischer Eisensorten (Information on the Passivity and Corrosion Resistance of Commercial Types of Iron) by Anton Koeniger, paper, 26 pages, 8⅛ x 11½ in., published by Westdeutscher Verlag, Cologne, Germany. Price 8.90 DM.**

Written in German this book relates to passivitation and corrosion resistance of various types of iron. It is report No. 960 of a series of research reports of the State of Nordrhein-Westfalen.

Topics include measuring methods and apparatus, construction of the potential-time curves, passivating time, passivatible and nonpassivatible types of iron, influence of heat treatment on the potential, combination of passivated and nonpassivated circuits, influence of alloy components on passivity, and substitution for carbon in gray iron by special components.

Steelmakers Re-enter Castings Market

PITTSBURGH — For the first time this year, there are unmistakable signs of a business upturn for foundrymen. Leading steel and gray iron foundries are melting five days a week, operating at close to capacity, and backlogging orders. August bookings of a major steel foundry were big enough to assure the company that it would operate at a high level through the fourth quarter even if sales in subsequent months drop sharply.

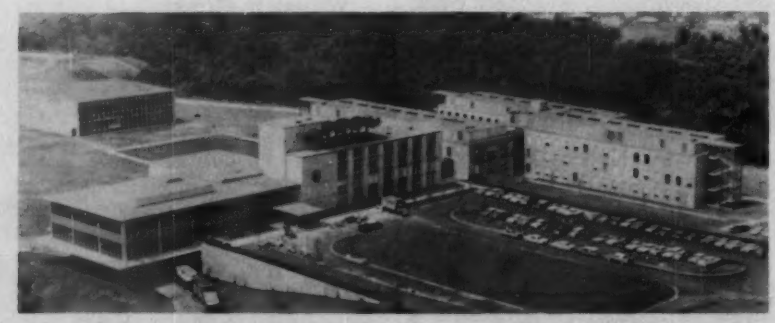
To a large extent, the upturn here reflects steady improvement in steelmaking operations. Local mills are pouring ingots at about 75 per cent of capacity, the highest rate in 17 months. They're back in the market for castings, and they're starting to rebuild their inventories of rolling mill rolls.

Shipments during the month of September by a leading roll manufacturer were the largest for any month since April, 1960. Early October bookings for rolls were somewhat below the previous month's, but big enough to sustain good production for the rest of the year. One rollmaker estimates that customers are carrying 50 per cent larger inventories than they had at the start of the year.

Although sales are trending upward at most of the larger foundries, some of the smaller job shops see little improvement. They're still living from hand to mouth as orders rise one week and fall the next. "We'll open on Wednesday and run only three days this week," says the owner of a gray iron foundry. "Business is still pretty spotty. We have no backlog, and it seems that we've been too high lately in bidding against out-of-town foundries."

For most foundries, the profit squeeze is becoming increasingly serious. Wages went up about 7 cents per manhour on Oct. 1, and prices of raw materials also are on the upswing. A large gray iron foundry raised its prices by 3 per cent on Sept. 15, but few of its competitors followed suit. As one foundryman explained, "We can't risk losing work by raising prices, so we're not going to raise them unless we're actually losing money on a job."

Jobbing foundries are hopeful that they'll get more work from Westinghouse Electric Corp. as a result of the firm's decision to close its big foundry at Trafford, Pa., by February, 1962. A local gray iron foundry already has received a few jobs from Westinghouse that it feels sure it would not have had if the company had not been phasing out its production at Trafford.



KOPPERS RESEARCH: Dedication ceremonies recently marked completion of the first stage of the Koppers Co.'s new Research Center in Somervell Park, Monroeville, Pa. It can accommodate 450 people. When all other buildings planned for the 176-acre site are completed, the Center will house about 1500

Casting Demand Varies in East

PHILADELPHIA — Casting demand is up, but not to the extent that had been anticipated by foundrymen generally.

Gray iron jobbers in the immediate area are operating in excess of 72 per cent, up about 5 points from a month ago. In some adjacent districts, however, it is questionable whether the gain has been that much. Over-all, the situation still is rather mixed.

Cast iron requirements for vacuum pumps and food processing equipment are active, and printing machinery is particularly strong. On the other hand, auto die work is disappointing, and specifications for textile and papermaking machinery are slow. Material handling equipment needs have been hit by a prolonged strike at a local plant.

Demand for steel castings remains slow—perhaps 50 per cent of normal, it is estimated. Ship work is up a little, but demand for heavy industrial equipment shows slight gain. Backlogs range around four to five weeks.

Lebanon Steel Foundry Co., Lebanon, Pa., has booked a Navy contract for $46,660 for valve bodies, and E. V. Camp Steel Works, Atlanta, has received a $42,000 contract for alloy steel castings for the Watertown, N. Y., Arsenal.

The lag in brass and bronze castings continues. Most job shops are operating at little more than 50 per cent, with no particular spurt in any one line. They are running around four to five days a week with limited working crews. Aluminum shops are maintaining a much higher rate, but are scratching for tonnage.

Malleable demand is well sustained, with operations at 78-80 per

Blast cleaning time cut in half breakage eliminated with spinner hanger cabinet

Castings which could not withstand tumbling action are blast cleaned quickly and safely in this versatile Wheelabrator Spinner Hanger Cabinet at Greenlee Bros. & Co.

A demonstration of WHEELABRATOR'S

VITAL VALUES

Although this Wheelabrator Spinner Hanger Cabinet has eliminated the problem of breakage of high tensile gray iron castings which were not suitable for batch mill cleaning, the big savings have come in reduced cleaning time. Blast times have been cut 50% by the efficient exposure of all surfaces to the blast of the two Wheelabrator units. With this versatile Wheelabrator, this foundry now cleans in 6 hours tonnage equal to their former 12-hour output. Abrasive and parts costs also are proportionately lower. Savings like these are vital to operating efficiency and profits—and are the heart of the values you get from Wheelabrator equipment and services. Write for complete information.

VITAL VALUES FOR INDUSTRY

WHEELABRATOR
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WHEELABRATOR CORPORATION, 505 S. Byrkit St., Mishawaka, Indiana. In Canada, WHEELABRATOR CORPORATION OF CANADA, LTD. 1901 Birchmount Rd. P.O. Box 490, Scarborough, Ontario
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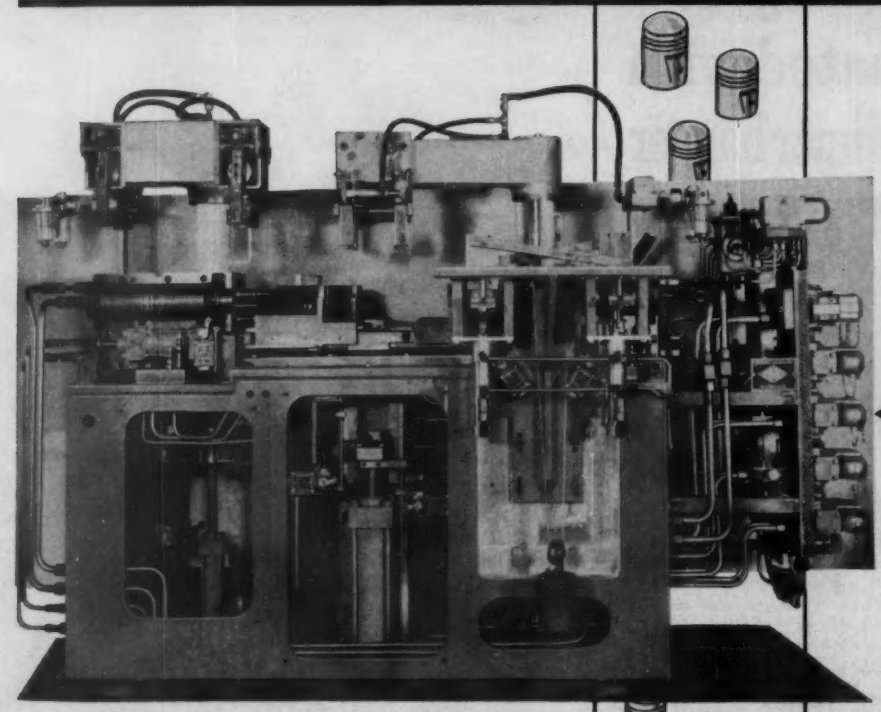
increase in output with two units . . . and one operator

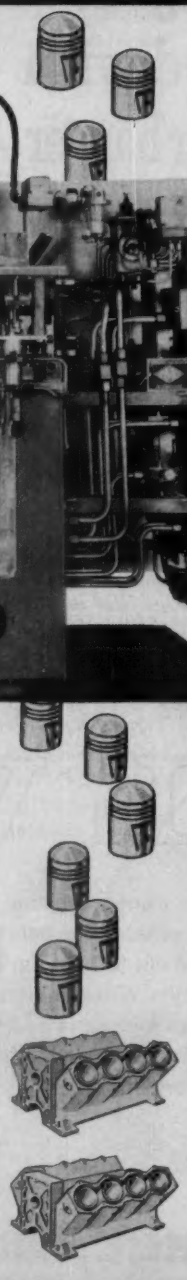


This Automated Piston Molding Machine is typical of the equipment that has been developed for industry by Permanent Mold Die Company, where designing and building special automated molding equipment is an important function.

This machine incorporates the advantages of metal molds and cores, manual or automatic operation, and adaptability to various sizes of pistons. IT HAS INCREASED THE RATE OF PISTON PRODUCTION ALMOST 600%!

The automatic cycle includes insertion of dimension-control bands into the mold, assembly and disassembly of molds and cores, and transfer of completed pistons to customer's chute or belt conveyor. These PMD machines are designed to operate in groups of two, UTILIZING A SINGLE OPERATOR. The operator can pour at one machine during piston solidification at the other. These machines are also adaptable to automatic ladling. Most of the processes of this machine are hydraulically actuated and all the electric, hydraulic, and pneumatic functions conform to Joint Industry Conference Standards.

The machines developed and built by Permanent Mold Die Co., can produce small parts such as pistons, as well as large automotive aluminum castings. This equipment is developed to **your** specifications, to meet **your** particular needs.



PMD automated molding equipment offers you a wider production potential at relatively low cost. Investigate its advantages for your operation.

PERMANENT MOLD DIE COMPANY

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cent of normal in most shops. Builders' hardware, pipe fittings, electrical fittings, and small tools are contributing the most to present activity.

Alan Wood Steel Co. recently put into operation the second of its two blast furnaces at Swedeland, Pa. It is the third district blast furnace to be blown in during the last few weeks.

Study Markets for Malleable

CLEVELAND — Malleable Founders Society's 12th Market Development Conference, to be held Nov. 1-3 at the Sheraton Cleveland Hotel, Cleveland, will focus on the potentially important government market. Interest in this market by the society is partially the result of successful development by one of its member companies of an artillery shell using pearlitic malleable iron. This project, now on a production basis for the government, is expected to lead to additional contracts for malleable foundries.

Speakers for the session include John V. Sagarese, member of the technical staff, Picatinny Arsenal; Col. Ralph M. McMahon, chief, Cleveland Ordnance District; and H. Mansell Evans, Pentagon specialist in small business matters.

In addition, the weldability and the machinability of malleable will be outlined in a series of "Shirtsleeve Seminars" in which information developed recently in the laboratory will be presented by men who conducted the research. These sessions will emphasize selling the advantages of malleable based on its behavior as a welding or machine tool workpiece.

Steel Founders' T&O Meeting Will Include 35 Papers

Thirty-five technical papers in five general areas of steel foundry practice will be presented during the sixteenth annual technical and operating conference of the Steel Founders' Society of America on Nov. 13-15 at Hotel Carter, Cleveland.

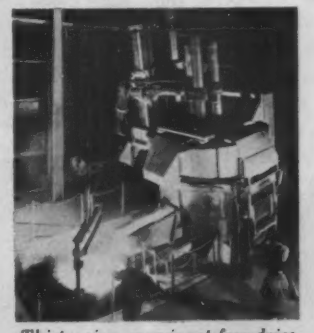
Featured speaker will be C. M. Stoch, assistant director of research, British Steel Castings Research Association, Sheffield, England. He will present his talk, "The

Double savings in electric furnace fume control

A demonstration of WHEELABRATOR'S

VITAL VALUES

Hundreds of pounds of foreign matter are removed daily from the atmosphere in each of the 54 Wheelabrator electric furnace fume control systems installed in prominent steel foundries. This quantity of dust and fume is removed at a double savings as a result of the Vital Values incorporated in each system. They provide the necessary efficiencies at a savings in initial costs compared to other possible methods. They repeat the savings daily because they are so much less costly to operate. A choice of hooding methods tailored to individual furnace requirements providing complete flexibility, no visible solids in the effluent gases and rock-bottom operating and maintenance costs are some of the Vital Values you get only from Wheelabrator.



Thirty-nine prominent foundries are now ventilating 54 electric furnaces with Wheelabrator fume control systems, handling a combined total of over a million c.f.m. of air. Send for full details.

VITAL VALUES FOR INDUSTRY

WHEELABRATOR

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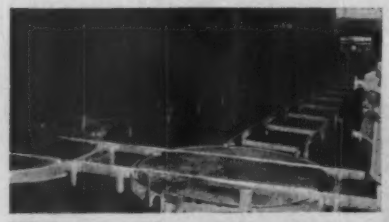
4,000 LB. MOLDS MOVE EASILY AND FREELY —

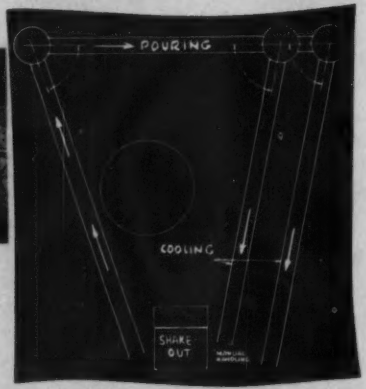
Large, palletized molds ride on NOMAD Heavy Duty Track (¾" x 3" special analysis steel rails).

Newly-installed at International Harvester's Milwaukee Works, this NOMAD Conveyor System gives great flexibility— features easy handling of molds of odd shapes and sizes, maintains a high production rate, and reduces manpower, too!



While turntables can be set at any degree, usually 90°, a key point of interest in this installation is the use of specially-indexed turntables routing molds at angles of 71° and 79° respectively.

Note the fabricated pallets which accommodate many mold sizes.



Basic NOMAD EQUIPMENT is shown here adapted to a specific installation. If you need a low-maintenance, "easy-to-handle" unit for your foundry, *Write Today*

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Efficient Use of Oxygen in Steelmaking in British Foundries," as an exchange lecture on behalf of his organization.

General topics of the sessions and the speakers are outlined below:

Monday

Operating Efficiency and Process Control: E. M. Layman, General Steel Industries; C. E. Haney and W. A. Meyer, ESCO Corp.; N. B. Grace, Symington Wayne Corp.; J. R. Speer Jr., Texas Foundries Inc.; K. T. Rinderle, Farrell-Cheek Steel Co.; and R. R. Tillman, Unitcast Corp.

Operating Efficiency in the Cleaning Room (panel discussion): E. O. Ellis, Massillon Steel Casting Co.; R. J. Flanigan and P. E. Eubanks, Ohio Steel Foundry Co.; and G. L. Winger, National Castings Co.

Luncheon: Welcome address, W. H. Moriarty, president, SFSA, and first vice president and group executive, National Castings Co. "Cave Man to Space Man," J. Lewis Powell.

Maintenance: P. A. Repino, Lebanon Steel Foundry; N. A. Mathison, ESCO Corp.; A. B. Croop, Washington Iron Works; T. O. Fritz, McConway & Torley Corp.; C. W. Abraham, Blaw-Knox Co.; and F. E. Noggle, Westover Corp. & Associates.

Tuesday

Melting: C. F. Sweets, Ross-Meehan Foundries; A. G. Linley, LFM Mfg.; and I. W. Sharp, Walworth Co.

Gas-Oxygen Torch (panel discussion): E. W. Ganslein, Buckeye Steel Castings Co.; and C. A. Weston, Oklahoma Steel Casting Co.

High Alloys (panel discussion): J. H. Baldrey, Union Carbide Metals Co.; and F. B. Anderson, melting consultant.

Luncheon: "Mind Over Matter," Dr. Henry Gerald. Presentation of society safety awards, James Holtzapple, Blaw-Knox Co., and chairman, SFSA safety committee.

Inspection: W. E. Davis, General Steel Industries Inc.; E. L. Kotzin, Bonney-Floyd Co., A. J. Whittle and W. Tait, Dominion Foundries & Steel Ltd.; C. M. Stoch, BSCRA; G. D. Gephart, Harrison Steel Castings Co.; S. W. Gearhart, Birdsboro Corp.; and E. W. O'Brien, Oklahoma Steel Castings Co.

Wednesday

Fundamentals of Core Sands and Binders: E. Vogel, Lebanon Steel Foundry; R. W. Heine, University of Wisconsin; and D. C. Williams, Ohio State University.

Luncheon: Presentation of product development contest awards.

Fundamentals of Core Sands and Binders: P. J. Neff, American Steel Foundries; and C. W. Briggs, SFSA.

NEW LABORATORY: Frank M. Cashin, president, Kaiser Refractories Div., Kaiser Aluminum & Chemicals Corp., is shown dedicating the company's new laboratory at Mexico, Mo. The modern facility houses research, development, and raw materials departments

Your castings carry your reputation...

it pays to find cracks before your customers do

No matter how carefully you control pouring, handling or other processing, cracks and other "invisible" defects are likely to appear in *some* of your castings. You owe it to yourself to find trouble makers as quickly, efficiently and economically as possible.

Not all cracks need rejection—or repair. But cracks in high stressed areas of parts are very serious. Extremely small cracks can cause early failure, if highly stressed!

First, finding all such defects early eliminates bad castings before they go to your buyer or before time is wasted in your own machining or assembly operations.

Second, even *more* important—a defective casting carries with it your reputation and your best chance for repeat business. Can you afford to wait for your customers to test your product for you—especially when you can identify any important defects so easily and economically with Magnaflux Test Systems?

Third, reliable quality is your own best protection against possible conversion from your castings to other means of fabrication. Consistent quality is "job insurance."

Magnaflux testing for magnetic metals and Zyglo for nonmagnetics are easy to use, positive and can save far more than they cost. The critical flaws you need to find appear directly on the part—actually glow with Magnaglo or Zyglo.

Magnaflux-Magnaglo and Zyglo fit into your operations at any point...wherever and whenever this will save you the most money to find and correct the cause of the defects. Many foundries now install Magnaflux or Zyglo "check-points" along their processing set-up to insure the quality and profits of their output—start to finish. For gray iron tests, the $195.00 type Y-5 yoke kit proves extremely useful.

Regardless of the size or kind of castings you make, from ounces to tons, a Magnaflux Nondestructive Testing Engineer can help you meet your planned requirements—for quality, cost—even market expansion. Ask to have him call soon...meanwhile write for data and case studies. MAGNAFLUX CORPORATION, 7350 West Lawrence Avenue, Chicago 31, Illinois.

With Magnaglo and black light, any cracks will show up as glowing indications. This casting was proved defect-free.

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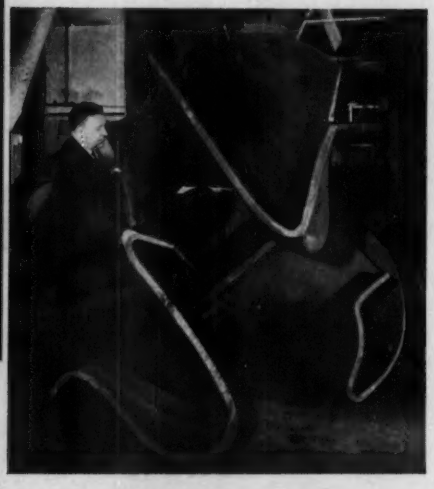
TEST SYSTEMS

For More Information Circle 658, Page 39

1100-pound core for ball casting made at Olympic Steel Works in just 20 minutes, using Liquid Carbonic's bakeless hardening process. Conventional methods would have taken 12 hours.

E. A. Slater, Liquid Carbonic Sales Representative, inspects a Navy destroyer's massive hawse pipe at Olympic. The CO_2 process reduced production costs on this unit by one-third.



HOW OLYMPIC STEEL WORKS OBTAINS NEW BUSINESS WITH CO_2 PROCESS

The Olympic Steel Works in Seattle had a problem. They had an order to produce hundreds of giant ball and socket castings, but had to meet a tight delivery deadline and reduce costs in meeting it. Not being a company to say something can't be done, Olympic accomplished both objectives, and other benefits, by using the Liquid Carbonic CO_2 core-hardening process.

New process saved over 11 hours in curing big cores

Previously, 1100-pound cores required 12 hours of curing. With Liquid Carbonic's bakeless CO_2 process, they were ready for the molds in just 20 minutes. The 700-pound cores took only 7 minutes (previously: 8 hours) and 6-pound cores, formerly requiring 2 hours, only 30 seconds. Needless to say, Olympic delivered ahead of schedule.

New business for new CO_2 process

This experience prompted the company to also use the CO_2 process to produce intricately shaped deck edge hawse pipe for Navy destroyers. No longer were dry sand casting cores required. And simplified patterns reduced production cost one-third. Of course, the castings were also produced faster and more accurately.

FREE BOOKLET

Call your Liquid Carbonic representative for a demonstration of the core-hardening process, or write for free CO_2 core-hardening booklet.

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New officers elected by the Non-Ferrous Founders' Society are, left to right, George W. Stewart, second vice president; Dan A. Mitchell, president; and Lawrence J. Andres, first vice president

Walter M. Clark, right, receives NFFS Distinguished Service Award from William L. Leopold, chairman of the awards committee

Non-Ferrous Founders' Society

Reports on Year's Activities

By FRANK G. STEINEBACH

● MEMBERS of the Non-Ferrous Founders' Society, meeting at Shawnee Inn, Shawnee-on-Delaware, Pa., Sept. 17-21, reviewed the business situation and found improvement (FOUNDRY, October, 1961, p. 17), heard reports on activities during the past year, received copies of the first section of the group's handbook, and protested the growing export of nonferrous scrap.

Dan A. Mitchell, Progressive Brass Mfg. Co., Tulsa, Okla., was elected president; Lawrence J. Andres, Lawran Foundry Co., Milwaukee, moved up to first vice president, and George W. Stewart, East Bay Brass Foundry, Richmond, Calif., was named second vice president. Herbert F. Scobie was reappointed secretary.

Walter M. Clark, B. W. Clark & Co., East Bridgewater, Mass., received the society's distinguished service award for his many years of service to the nonferrous foundry industry.

Protests Scrap Export—The society passed a resolution "that the membership of the society request and strongly urge the government of the United States to quickly institute limitation on the export of copper alloy scrap to assure return to normal and historic relationships between export and domestic needs."

Export of copper-alloy scrap rose from 29,407 tons in 1959 to 122,957 tons in 1960, and is continuing at even a higher rate in 1961. This seriously endangers the supply of valuable raw material which, on conversion to ingot, becomes the basic melting stock of brass and bronze foundries. Furthermore, shortage of scrap raises prices of ingot and hence casting prices, thus providing inflationary pressure.

Business Analysis—Speaking on "Business Analysis and Profit Evaluation," John E. Graf, treasurer and controller, Mansfield Brass & Aluminum Corp., Mansfield, Ohio, presented statistics to show why manufacturing companies fail. Inexperience and incompetence caused 94.3 per cent of the failures; competitive weakness, 54.3 per cent; re-

Re-elected officers of the Cast Bronze Bearing Institute are, left to right, Raymond O. Oyler, secretary-treasurer; Carter N. Paden Jr., president; and A. G. Eberle, vice president

ceivable difficulties, 11.8 per cent; excessive fixed assets, 10.9 per cent; heavy overhead expense, 7.8 per cent; and inventory difficulties, 4.8 per cent.

The largest single cause, inadequate sales, can result from poor sales effort, lack of knowledge of the product, or poor costing procedures leading to overpricing the product. The second largest cause, competitive weakness, results almost exclusively from inadequate or false cost information. The third cause, excessive receivables, emphasizes the importance of having adequate working capital, and the fourth cause, excessive fixed assets, points to the need for balancing equipment against the limits of the capital structure.

Looking back on some of the charts presented at the meeting a year ago, Mr. Graf emphasized the advantages gained by a foundry participating in the cost comparison groups. Some trends that were apparent and reported in the first quarter of the year carried through, and foundries in the group could take necessary steps to correct abnormal situations before the year was completed.

Comparison of the 1959 and 1960 business analysis and profit evaluation reports showed that in almost all instances the ratios for 1960 are less favorable than those of 1959—due, of course, to the sharp business decline. The return on tangible net worth decreased, considering the group as a whole. Return on net sales for the group remained almost constant at 4.7 per cent, which can be considered a very good performance. When foundries are considered by group classifications, however, the record is not so good; foundries with small sales volume suffered the worst. The speaker discussed other ratios included in the report and in conclusion stressed the available services of the national society to provide a broader picture of present day problems.

Handbook Discussed—The first section of the new handbook, entitled Copper, Brass and Bronze Castings—Their Structures, Properties and Applications, was distributed, and the contents were discussed in some detail by the author, Dr. Richard A. Flinn, professor of metallurgical engineering, University of Michigan, and technical consultant for the society. Dr. Flinn indicated that because it is necessary to have the design engineer understand the product, this book endeavors to give such technical information as is necessary to the proper selection of alloys.

The first part of the book deals with the structure of copper and its alloys, and the second, with the properties of copper-base alloys, including physical properties, electrical and thermal conductivity, magnetic properties, corrosion resistance, wear and abrasion, machinability, and weldability. Exceptionally fine four-color illustrations add much to the discussion.

The second volume of the handbook, which will be published later, will deal with considerations involving casting design, tolerances, surface finish and production methods; case histories; and availability, terms and conditions of sale, interpretation of specifications, and quality control.

Applications Cited—H. G. Ta-

Cleaning room costs are a part of the price of your product. Reduction of these costs may well spell the difference between swimming and sinking.

National Metal's **New Controlled "T"®** shot and grit, for instance, represents a new break-through for chilled iron users: A half a ton of **New Controlled "T"®** will do the work of a full ton of ordinary chilled iron abrasives. Sure, you get longer life, but abrasive costs are only a part of cleaning room costs. Savings in maintenance and time add up to a hefty plus factor, too!

National Metal's **Permabrasive®** will clean 20% faster than steel . . . saves you money in first cost, time and results. **Perma-Steel®** will last as long and clean as well as steel, but costs a great deal less.

Reduce the cost of your product by reducing cleaning room costs and add to your profits . . . it's just that simple. By the way, we can prove all this without upsetting your present operations. Write for free booklet: "The Facts of Life Concerning the Use of Shot and Grit."

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Stop the count-down right there! This is the best size for an air-powered pencil grinder, the right size for any hand that holds it. The new Model 505 launched by Master Power is 4¾" long, 1" in diameter, 8 ounces light, 40,000 revs fast — specifications that spell maximum efficiency with carbide burs and rotary files. The power plant is an internal 3-blade motor (not a turbine) floating on a long-life chrome-plated shaft. It responds with instant torque. So powerful, it produces a ¼-horse! The new 505 is beautifully built to save time and dollars for foundries, metal fabricators, ceramic finishers and tool and die shops. Ask your local Master Power distributor for a demonstration, or mail us the coupon below.

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This is ACTUAL SIZE of the 505. And look. No buttons or levers to get in your way. Finish is satin-smooth, anodized.
No annoying air blast. The 360° diffused exhaust muffler is safe, quiet. On-off valve is self-sealing. Just twist to select speeds.
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Please send me complete data on the new Model 505 Pencil Grinder.

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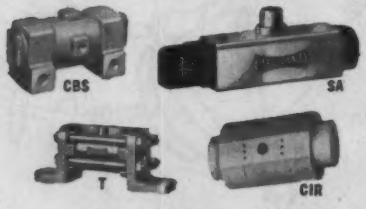
For More Information Circle 661, Page 39

Put a Cleveland portable VG 2 vibrator on your core boxes for increased core production, faster and cleaner draws, longer core box life, without core distortion. Quickly attached with serrated steel jaws, the VG 2 develops 8000 vibrations per minute. Speed is adjustable for all core sizes.

You get top performance from all your foundry equipment with a Cleveland vibrator speeding production on core machines, roll-over machines, molding sand hoppers, screens, chutes, bins and wherever materials are handled.



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For More Information Circle 662, Page 39

racks, chief metallurgist and head of Engineering Laboratories, GMC Truck and Coach, Pontiac, Mich., stated that copper-alloy castings are used in GMC trucks and GM coaches mainly for two specific purposes—superior corrosion resistance in water cooling and air brake systems and good bearing and wear properties. Aluminum-alloy castings are used for a wide variety of applications, due to such characteristics as light weight, good strength-to-weight ratio, corrosion resistance, and appearance.

Copper-base alloys for corrosion resistance are made from SAE 40 or 41 alloys. Because of better castability, SAE 40 is preferred in more complex castings like valve bodies or pump housings. In bearing or wear applications where light to moderate loads against hardened steel are involved, SAE 660 is specified. Heavier loads use phosphor bronze SAE 64 and nickel phosphor bronze 640. Manganese bronze castings made from SAE 43 alloy are used where the part is not highly loaded.

For zinc diecasting SAE 903 and SAE 925 are used. Applications include fuel pumps, carburetors, windshield wipers, hardware, nameplates, and other decorative trim.

Of the more than 30 aluminum alloys available, Mr. Taracks' organization selected 9 to cover the various requirements. These alloys and their applications are as follow: 319 (modified) general purpose castings; 355, transmission and angle drive housings, brake shoes, low inertia flywheel; 356, transmission and fan drive housings, intricate valve bodies; 40 E, door actuating handle, brake pedal; F214, decorative castings; F132, engine pistons; 380, grab rail bracket; 43, thin intricate castings requiring ductility; 220, engine supports, fuel tank bracket.

Mr. Taracks stated that improving casting technique to assure a leakproof part should be the goal of every foundry. This achievement would remove a nuisance problem and reduce extra manufacturing costs. If better assurance could be given that good quality castings can be produced consistently without paying an excessive price penalty, the use of aluminum castings could be expanded greatly.

President Dan Mitchell reported on the marked success of the society's first castings clinic held in Tulsa recently. A feature of the clinic, attended by users of nonferrous castings, was a discussion of the engineering material in the first volume of the handbook. Clinics will be held in other sections of the country.

Speaking at the annual business meeting luncheon, Frank G. Steinebach, publisher and editorial director of FOUNDRY, praised the society for its progress since it was organized in 1943. He stressed the need for greater attention to casting quality and meeting delivery promises, as the first step in extending the use of copper-base and light metal alloy castings.

Mr. Steinebach urged the society to undertake the gathering of production and sales statistics of the nonferrous foundry industry. He also emphasized the need for a market research study to determine present and potential applications for nonferrous castings.

Cast Bronze Bearing Institute, a product group of NFFS, re-elected last year's officers. They are Carter N. Paden Jr., Moccasin Bushing Co., Chattanooga, Tenn., president; A. G. Eberle, Renewal Service Inc., Philadelphia, vice president; and Raymond O. Oyler, Bunting Brass & Bronze Co., Toledo, secretary-treasurer.

Speaking on "Why We Like Sleeve Bearings," C. L. Pope, Eastman Kodak Co., Rochester, N. Y., at a meeting of the institute on Sept. 21, stated that sleeve bearings offer a challenge to the engineer because he has a wide choice of materials, each with its own characteristics. Such bearings have reliability, and they are easily installed or replaced.

Mr. Pope pointed out, however, that in spite of all the sleeve bearings in service, they have been sadly neglected by engineers. This neglect has resulted in other bearings being used as an easy way out, whether they are proper bearings or not. He praised the work of CBBI, which makes it reasonably easy for the engineer to design for predictable performance of sleeve bearings. He stated further that the designer should not look at a sleeve bearing as a cheap bearing, but one that has been well engineered and is worth its cost.

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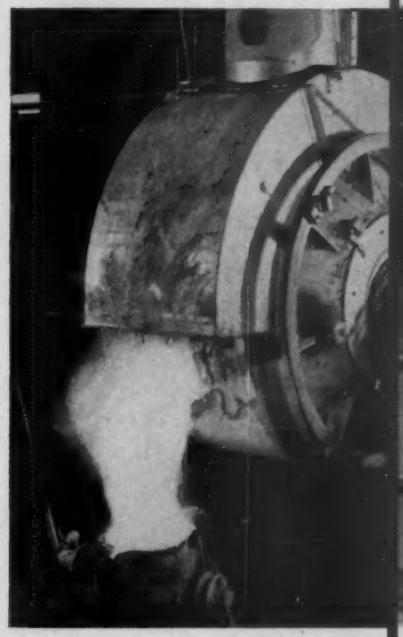

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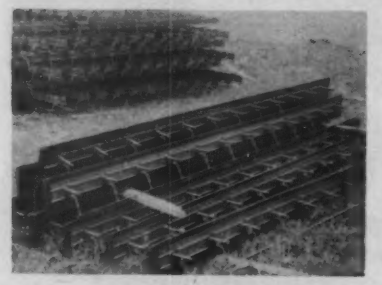
One Way to Develop

A Market for Castings

A transverse joint for concrete highways has developed into a sizable and growing market for malleable iron castings. Here's how the Eastern Co. created the business for its Frazer & Jones Div. foundry

Above, Carl W. Weber, F & J managing director (left), and Elmer J. Webb examine a highway transverse joint section. Inset shows malleable iron castings used on a transverse joint



Joints are delivered already assembled. This has contributed to the success of the product

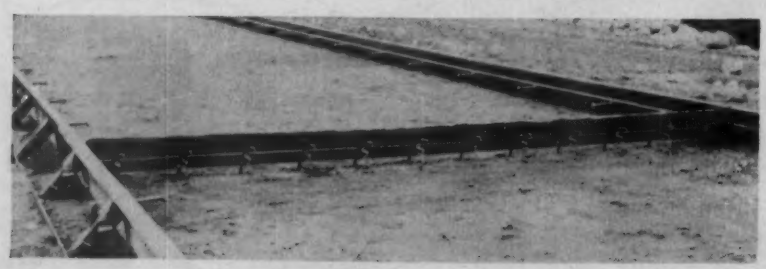
● DEVELOPMENT of new markets for castings has led one malleable iron foundry to purchase and manage a complete sales organization for specialty products used by the construction industry. Frazer & Jones Div., Eastern Co., Syracuse, N. Y., now runs Thompson Materials Corp., Belleville, N. J., as its marketing arm for special malleable iron joints for concrete highways.

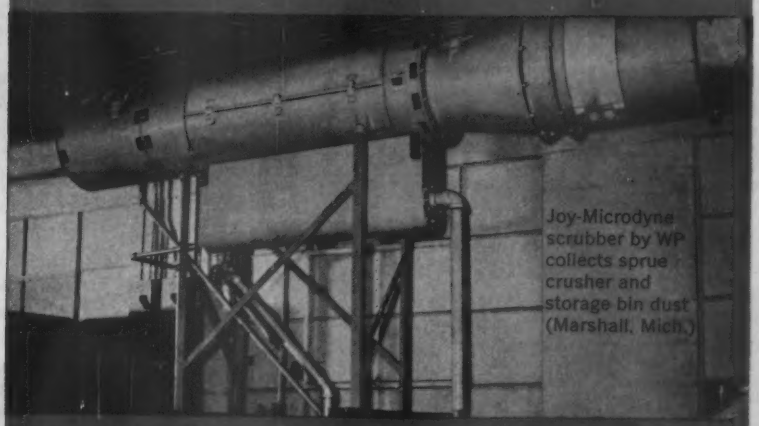
During the two years the foundry has been making these products, they have gained growing acceptance by highway engineers and contractors. But the growth of the market for these particular castings did not occur without cultivation. As Carl W. Weber, managing director of Frazer & Jones, explains, "We build sales by meeting the needs of growth markets, creating efficiencies for customers through research and development, efficient manufacturing, and application and methods engineering. That's our business philosophy."

Market Investment—Weber adds that the company is investing four times as much money in research and development as the average foundry. The largest share is going into development of methods, products, and materials to meet requirements of increasing loads on highways at lower costs.

Frazer & Jones acquired the product, known as Rodemetal, in 1959 from its inventor, Elmer J. Webb, who joined the company as manager of Rodemetal development. Immediately, the company set out

View shows an installed length of transverse joint before concrete is poured. The plate supported by the malleable legs is steel





Joy-Microdyne scrubber by WP collects sprue crusher and storage bin dust (Marshall, Mich.)

Gray iron foundries in Michigan... and in Southern California...agree:

Dualaire Reverse Jet Filter by WP collects sand mold shake-out dust (Los Angeles, Calif.)

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For More Information Circle 644, Page 39

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For More Information Circle 665, Page 39

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to develop a bigger market for its new product. As a result of efforts by the company's research and development and engineering departments, the load bearing strength of the highway joint was doubled. Also, it is the only load transfer device acceptable to the state of New York which offers equal support of both blocks of pavement it joins. These improvements were achieved with no appreciable increase in the cost to contractors.

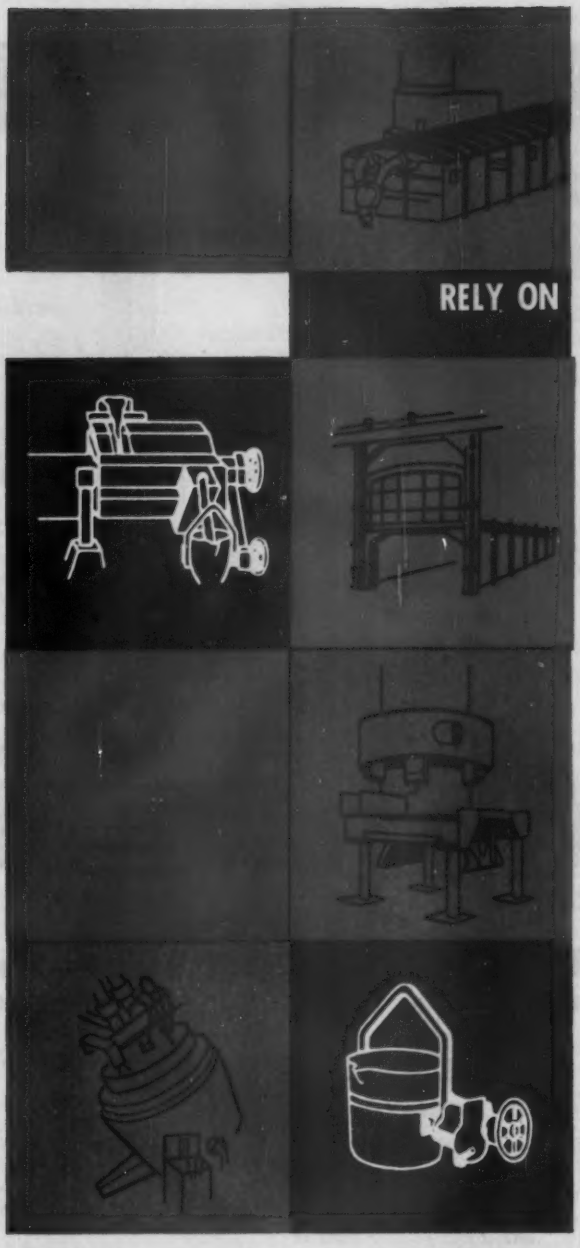
Growing Market—Due to these advances, the highway joints this year will represent about 10 per cent of the foundry's volume and double the amount of its business in the highway field in 1960. In 1961, the company expects to move about 250 tons of Grade A malleable iron in the form of the transverse joints and longitudinal joints and bolts also required. Each assembly of 24 transverse joint units weighs about 50 lb.

A two-lane concrete highway requires a transverse assembly of 24 units for each 40 ft of highway length; about 130 assembled joints, or 6500 lb, are required per mile. In addition, the foundry supplies the centerline longitudinal joints running the entire length of highway. These total 1600 lb per mile or 4800 lb per mile when the curbs are included.

During the early period, the product was sold directly from the Syracuse factory and its marketing area was limited largely to New York state. The sales potential proved by the rapid acceptance of this joint called for broadening its market and establishment of additional distribution points to provide prompt delivery to job sites throughout the growing market area.

A marketing agreement was reached with Thompson Materials, the Northeast's largest single source of specialty products for the construction industry. The sales curve shot upward as the product moved out of Thompson yards in New Jersey, Buffalo, and Syracuse.

The sales arrangement led to the purchase of Thompson by the Eastern Co., which put it under Frazer & Jones management. The first marketing goals will be additional states in the Northeast, but management contemplates gradual licensing of distributors in other areas.



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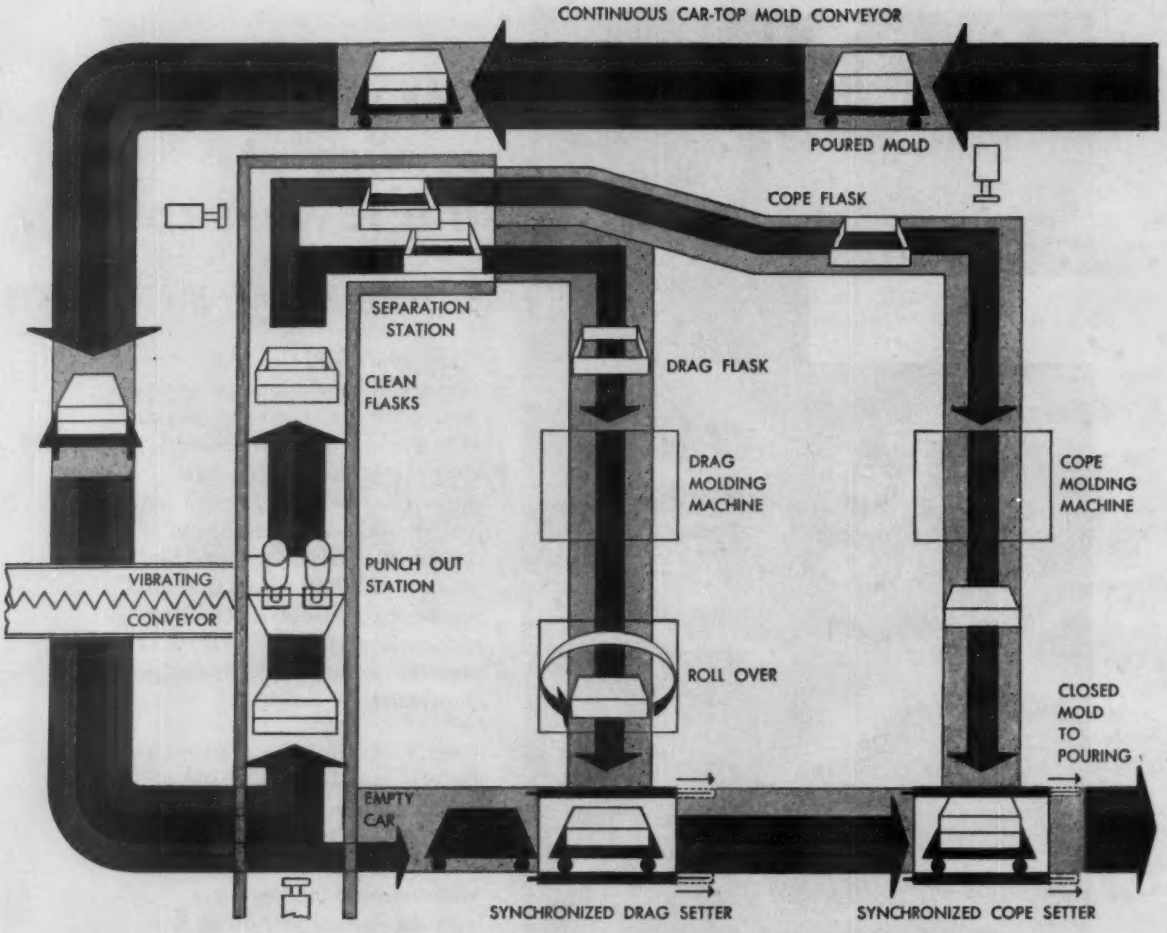

New Automatic Flask Handling System

...ANOTHER EXAMPLE OF PLANET VERSATILITY

This new Planet automatic flask handling system, installed in a large automotive foundry, is another example of how *Planet Versatility* saves time and money, and increases efficiency and production. The system automatically guides 300 molds per hour through a complete casting cycle . . . *and it will pay for itself in less than one year.*

HERE'S HOW IT WORKS:

After molding, the drag flask (center of diagram) is rolled over 180 degrees and with split-second timing is positioned on a continuously moving car-top mold conveyor. Next, it is conveyed to where the completed cope, without stopping the line, is gently and accurately placed on the drag. The closed mold is then poured, the only manual operation on the line.

The poured mold continues on the car-top mold conveyor to where it is pushed onto the punch out station. Here the castings and sand are dropped onto a double-decked vibrating conveyor for disposition. The clean flasks then move to the separation station, are separated, and returned to their respective molding machines to be refilled and recirculated through the system.

Powered rollers throughout the system hold flask wear and damage to a minimum . . . there is no sliding contact on this Planet engineered system.

Custom designed systems, such as this automatic flask handling system, have helped build Planet Corporation's reputation as a *versatile* organization with solutions to perplexing production, materials handling and automation problems. Let Planet demonstrate how its "PV" engineering skill can help you . . . you'll find that *it pays to plan with Planet.*

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LITERATURE for Foundrymen

For More Information, Use Reader Service Card—Page 39

Sand-Throwing Machines

Bulletin 320 illustrates and describes line of Sandslinger sand-throwing units. Basic principles, application and operation information, and foundry installations are explained.—Beardsley & Piper Div., Pettibone Mulliken Corp., 2424 No. Cicero Ave., Chicago 39, Ill.

For More Details Circle No. 457—Page 39

Gas Burners

Bulletin 223G contains information on an extension of the range of the company's Series 223G gas burners to ¾-in. to 6-in. sizes.—North American Mfg. Co., 4455 E. 71st St., Cleveland 5, Ohio.

For More Details Circle No. 458—Page 39

Roof Exhausters

Aluminum, vertical-discharge roof exhausters are covered in Catalog 60. Complete specifications and ratings are given. —Iron Lung Ventilator Co., 5403 Prospect Ave., Cleveland 13, Ohio.

For More Details Circle No. 459—Page 39

Controlled Feeding Systems

Brochure presents information on company's line of metering, feeding, filtering and control equipment.—BIF Industries Inc., P. O. Box 1342, Providence 1, R I.

For More Details Circle No. 460—Page 39

Spray Nozzles

Pneumatic atomizing spray nozzles with internal air valve controls are illustrated and described in bulletin 114. Typical installation is described schematically.—Spraying Systems Co., 3238 Randolph St., Bellwood, Ill.

For More Details Circle No. 461—Page 39

Closed Circuit TV

Brochure discusses closed circuit TV for industry use. System specifications also are given.—Electronics Division, Fairbanks, Morse & Co., 100 Electra Lane, Yonkers, N. Y.

For More Details Circle No. 462—Page 39

Magnesium Tooling Plate

Brochure on advantages of magnesium tooling plate discusses its mechanical properties, sizes, and thickness tolerances.—Dow Metal Products Co., division of Dow Chemical Co., Midland, Mich.

For More Details Circle No. 463—Page 39

Thermocouple Assemblies

Revised catalog G100-1 gives complete details of general purpose and special use thermocouple assemblies. Resistance tables, specifications, and price schedules are provided.—Minneapolis-Honeywell Regulator Co., Wayne & Windrim Avenues, Philadelphia 44, Pa.

For More Details Circle No. 464—Page 39

Face Masks

Folder illustrates interchangeable respiratory equipment used to protect against dust, fumes, and other airborne hazards.—Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.

For More Details Circle No. 465—Page 39

CO_2 Process

Booklet on CO_2 process discusses principles, additives, and mixing and gassing techniques.—Liquid Carbonic Div., General Dynamics, 135 So. LaSalle St., Chicago 3, Ill.

For More Details Circle No. 466—Page 39

Automatic Specimen Mounting

Issue No. 3, Vol. VII, *Metal Digest*, features automatic presses for specimen mounting. Specifications are included.—Buehler Ltd., 2120 Greenwood St., Evanston, Ill.

For More Details Circle No. 467—Page 39

Did You Miss These?

Here is a list of popular literature items offered in recent months:

ALUMINUM ALLOY FLUXES—Apex Smelting Co., Chicago 12, Ill. Circle 451, Page 39.

DIE TEMPERATURE CONTROLLER—Industrial Mfg. Corp., Indianapolis 4, Ind. Circle 452, Page 39.

RISER SLEEVES ("How to Determine Feedex Riser Sleeve Sizes for Steel Castings")—Foseco Inc., Cleveland 35, Ohio. Circle 453, Page 39.

CORE BINDER—Knefler-Bates Co., Indianapolis, Ind. Circle 454, Page 39.

SILICONE RELEASE AGENTS (Booklet S-13) — Silicone Products Dept., General Electric Co., Waterford, N. Y. Circle 455, Page 39.

CASTABLE REFRACTORIES—Kaiser Refractories & Chemicals Div., Kaiser Aluminum & Chemical Sales Inc., Oakland 12, Calif. Circle 456, Page 39.

Industrial Cranes

Information on single and double-girder cranes with up to 50-ton capacity is contained in four-page, illustrated bulletin.—Michigan Crane Inc., 2323 E. Eight Mile Rd., Warren, Mich.

For More Details Circle No. 468—Page 39

Laboratory Equipment

Catalog 61 contains 44 pages featuring laboratory and industrial equipment, including electric furnaces, hot plates, and pyrometers.—Thermolyne Corp., 622 Huff St., Dubuque, Iowa.

For More Details Circle No. 469—Page 39

Bin Outlets

Bulletin describes hyperbolic outlets for speeding flow of granular or lump materials from bins and preventing bridging. Specifications and diagrams are provided. —Bin-Dicator Co., 17190 Denver, Detroit 24, Mich.

For More Details Circle No. 470—Page 39

Air-Power Equipment

Bulletins BM-25R, FP-60, and ML-5 illustrate and describe company's line of controlled air-power equipment, such as air motor and fluid power components.—Bellows Co., division of International Basic Economy Corp., Akron 9, Ohio.

For More Details Circle No. 471—Page 39

Makeup Air Units

Sixteen-page illustrated bulletin provides pertinent data, descriptions, and specifications for gas-fired makeup air units and accessories.—Metals Engineering & Mfg. Co. Inc., 8824 Lyndon, Detroit 38, Mich.

For More Details Circle No. 472—Page 39

Safety Floor Tread

Pressure sensitive safety tread fabric to prevent slips and falls is described in folder. A sample swatch is included.—Carborundum Co., P. O. Box 337, Niagara Falls.

For More Details Circle No. 473—Page 39

Speed Changers

Bulletins illustrate and describe company's line of speed changers. Features and control options are included.—Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

For More Details Circle No. 474—Page 39

Wet Blasting Methods

Handbook, "40 Precision Finishing Operations Where You Can Cut Costs by Liquamatte Wet Blasting," illustrates wet

blasting methods that cut precision finishing costs.—Lord Chemical & Equipment Div., Wheelabrator Corp., 2068 S. Queen St., York, Pa.

For More Details Circle No. 475—Page 39

Safety Plate

Eight-page brochure describes raised lug pattern steel plate safety flooring material. Weights, sizes, and installation instructions are included.—Joseph T. Ryerson & Co. Inc., Box 8000-A, Chicago 80, Ill.

For More Details Circle No. 476—Page 39

Thermometers

Bulletin contains specification data on recorders, recorder-controllers, indicators, union connections, and other thermometer equipment.—Barber-Colman Co., Wheelco Industrial Instruments Div., Rockford, Ill.

For More Details Circle No. 477—Page 39

Rust Control Guide

Data file details causes of rust, control methods, and prevention products available. Case studies are given with control methods.—Magnus Chemical Co. Inc., M-88-6 South Ave., Garwood, N. J.

For More Details Circle No. 478—Page 39

Molding and Coremaking Machines

Leaflet A-24 describes and illustrates shell molding and coremaking machines. Overall dimensions and effective mold sizes are explained for each model.—Foundry Suppliers Ltd., 25A Cockspur St., London, S.W.1, England.

For More Details Circle No. 479—Page 39

Wound Rotor Motors

Bulletin 104 contains information on 1 to 30 hp wound rotor motors. Construction features and dimensions are provided.—Louis Allis Co., 427 E. Steward St., Milwaukee 1, Wis.

For More Details Circle No. 480—Page 39

Belt Conveyor Data

Complete statistical data and charts in Bulletin 175 explain how to calculate horsepower requirements for conveyor belt systems. All variables are covered.—Hewitt-Robins, Dept. CBE, Stamford, Conn.

For More Details Circle No. 481—Page 39

Precision Tools

Catalog No. 27, third edition, contains information on hand measuring tools, dial indicators, and gages, and other tools

and instruments. Reference tables and index to all new tools are included in the 480 pages.—L. S. Starrett Co., Anthol, Mass.

For More Details Circle No. 482—Page 39

Liquid Oxygen Cylinders

Brochure describes liquid oxygen cylinders that meet all ICC safety specifications. It also describes cylinders for use with liquid nitrogen and argon.—Linde Co., division of Union Carbide Corp., 270 Park Ave., New York 17, N. Y.

For More Details Circle No. 483—Page 39

Cranes

Booklet illustrates and describes series D cranes including overhead, bridge, and trolley. Charted specification data are provided for all types.—Manning, Maxwell & Moore Inc., Crane Hoist Div., Muskegon, Mich.

For More Details Circle No. 484—Page 39

Mounted Wheels and Points

Bulletin 660 deals with mounted wheels and points for portable and stationary grinders. It covers grain sizes, grades,

Now! Melt BETTER...FASTER...at LESS COST with the NEW U. S. "SKLENAR" REVERBERATORY FURNACE

Available either gas or oil fired, in sizes ranging from 500 to 2000 lbs.—iron, brass and bronze (Yard these capacities for aluminum melting).

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- Simple hooding of hopper opening insures excellent working conditions—eliminates need of dust collecting equipment when operating in restricted areas.
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If you have a problem in the economical melting of iron or brass and bronze castings, if you have difficulty in obtaining desired production goals, *If you have any problem at all*—it will pay you to investigate the U. S. "Sklenar" Reverberatory Furnace . . . the world's most advanced melting furnace. Want proof? Case history data on file will convince you. Get all the money-saving facts today. Wire, write or phone.

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NEW METHOD KEEPS METALS BRIGHT DURING HOT-WORKING

LCA-Developed Lithium Vapor Generator Eliminates Scale Formation

Now, metals can be kept bright and scale-free during hot-working without the complicated chemical controls and bulky equipment formerly required. Industrial tests have shown that injecting vapors of lithium compounds into the working atmospheres of hot mills and furnaces effectively reduces scale already present on the metal and prevents formation of new scale. LCA has developed equipment for accomplishing this injection simply, efficiently and economically.

The Lithium Vapor Generator is essentially a compact combustion chamber that can be attached to the wall of the hot mill or furnace. It is fitted with a standard gas burner that utilizes plant fuel gas. Electrical controls are contained in a separate panel box that can be mounted nearby or at a remote point.

The source of lithium vapors is a cylindrical cake consisting of a mixture of lithium chloride and lithium carbonate. Each unit charge contains 7⅛ ounces of the salt, an amount ordinarily sufficient for an eight-hour run.

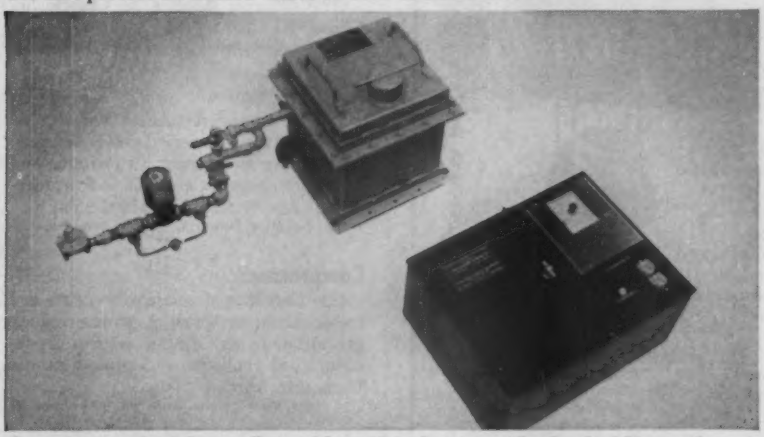
Introduction of the lithium-compound vapor into the working atmosphere produces a three-fold action:

1. It controls the oxide-forming gases to provide a protective atmosphere.
2. The vapors are adsorbed on the surface of the metal, forming a protective coating that also acts as a die lubricant in rolling and drawing.
3. The vapor diffuses into the refractory lining of the generator and mill, and feeds back into the working atmosphere to maintain equilibrium during the operating cycle.

The new method not only solves the problem of scaling as such, but can also eliminate pickling...produce raw materials savings...economize on labor... reduce the housekeeping problems associated with abundant scaling...prolong roll life in rod mills.

The Lithium Vapor Generator requires a minimum of operator attention and maintenance. It is constructed for easy dismantling and inspection. Use of standard components insures immediate replacements if accidental damage occurs.

The lithium compounds used are nontoxic under recommended conditions of use and present no hazard either to men or machines.



Generator consists of a small metal box, 15 inches on a side, fitted with a gas burner. Separate panel box contains electrical controls.

LITHIUM INJECTION HELPS CURE CASTING TROUBLES

A valuable complement to the Lithium Vapor Generator is the LCA Lithium Copper Cartridge for inoculating copper melts. The cartridges provide a means for injecting lithium directly into molten metal. Thus applied, the lithium scavenges out oxygen and other occluded gases, increases fluidity, lowers pouring temperature and refines the grain.

The cartridges are conveniently sized to contain .005, .01, .02 and .24 pounds of lithium metal. Though requirements for lithium vary with condition of melt, a basic charge of one part lithium to ten thousand parts copper is indicated. Thus, melts from fifty pounds to twenty-four hundred pounds of copper can be treated with a single appropriately sized cartridge.

The thin-walled cartridges give fast reaction in the ladle. Their thin design provides ease of handling and storage. The special hermetic seal insures permanent shelf life of the contained lithium.

LITHIUM IN BRIEF

New developments involving lithium are constantly appearing in the literature. Each month some will be mentioned here briefly.

Silver-copper alloys with minor additions of Li, indium and palladium are used in bonding stainless steel honeycomb. As little as 0.2% Li in the ternary alloy makes it suitable for this purpose. Use in the B-58 and B-70 structures is described. (6770)

Ag-Cu-Li brazing compositions are commercially available for joining noble metals. The addition of 1% lithium confers self-fluxing properties as well as improved wetting and spreading. Ag-Li filler has been used to braze beryllium sandwiches. (4973)

Analytical data were plotted and discussed for Li-Mg alloys. (4817)

Aluminum alloys containing 0.5-2.0% Li and small percentages of Cu alone or with Mn and (in some cases) Cd were studied. Li additions increase strength in the aged alloys. (4864)

For further information, write our Technical Service Dept., Bessemer City, N.C.

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For More Information Circle 671, Page 39

bonds, and operating speeds.—Simonds Worden White Co., 1101 Negley Place, Dayton 7, Ohio.

For More Details Circle No. 485—Page 39

Crane Hooks

Engineering dimensions of heavy-duty mill crane hooks in capacities from 5 to 200-tons are given in Bulletin 860.—American Forge & Mfg. Co., Box 20, Nichol Ave., McKees Rocks, Pa.

For More Details Circle No. 486—Page 39

Radiant Gas Burners

Bulletin DB-2 covers radiant-type gas units, including their advantages, design and construction features, operating principles, dimensions and capacities.—Selas Corp. of America, Dresher, Pa.

For More Details Circle No. 487—Page 39

Self-Contained Scales

Bulletin 8003 provides details of self-contained warehouse scales in cabinet or pillar dial models.—Scale Div., Fairbanks, Morse & Co., 100 Electra Lane, Yonkers, N. Y.

For More Details Circle No. 488—Page 39

Conveyors

Catalog illustrates and describes company's line of conveyors, components, steel beltings, side chains, and sprockets.—May-Fran Mfg. Co., 1710 Clarkstone Rd., Cleveland 12, Ohio.

For More Details Circle No. 489—Page 39

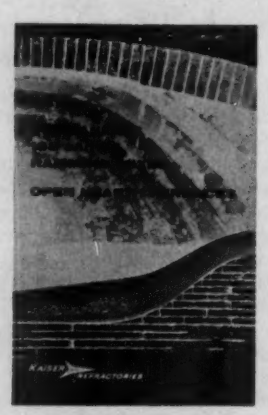
Foundry Supplies

Booklet features information on line of foundry supplies and equipment including core barrows, trucks, and racks; bottom boards; riddles; flasks; etc.—Arco Welding Service, 4727 S. Hoyne Ave., Chicago 9, Ill.

For More Details Circle No. 490—Page 39

Ramming Mixes

Revised handbook covers Permanente 165 and 84 periclase ramming mixes.



Mixing, ramming, and heat-up method are described.—Kaiser Refractories Div., Kaiser Center, Oakland 12, Calif.

For More Details Circle No. 491—Page 39

Suspended Separation Magnets

Bulletin 1032 describes line of oil-filled suspended separation magnets and explains use of automatic tramp iron removal assemblies.—Stearns Magnetic Products, 635 So. 28th St., Milwaukee 46, Wis.

For More Details Circle No. 492—Page 39

Heating Furnace Controls

Folio 122 illustrates and describes heating furnace control systems, including hydraulic, electrohydraulic, and sub-systems.—GPE Controls Inc., 240 E. Ontario St., Chicago 11, Ill.

For More Details Circle No. 493—Page 39

Air Systems

"Design Considerations for Make-up Air Systems," first in a series, points out need for make-up air systems; its planning and design, components, and basics of arrangement.—Reznor Mfg. Co., Mercer, Pa.

For More Details Circle No. 494—Page 39

Compressors

Complete line of company's engine and motor-driven compressors, power engines, gas turbines, and control systems is described in bulletin. — Cooper-Bessemer Corp., Mt. Vernon, Ohio.

For More Details Circle No. 495—Page 39

Fire Extinguishers

Twelve-page illustrated booklet provides data, descriptions, and specifications for company's line of portable fire extinguishers, smoke and fire detectors, and built-in carbon dioxide systems.—Walter Kidde & Co. Inc., 675 Main St., Belleville, N. J.

For More Details Circle No. 496—Page 39

CM METEOR

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• FOR HEAVY DUTY FOUNDRY SERVICE

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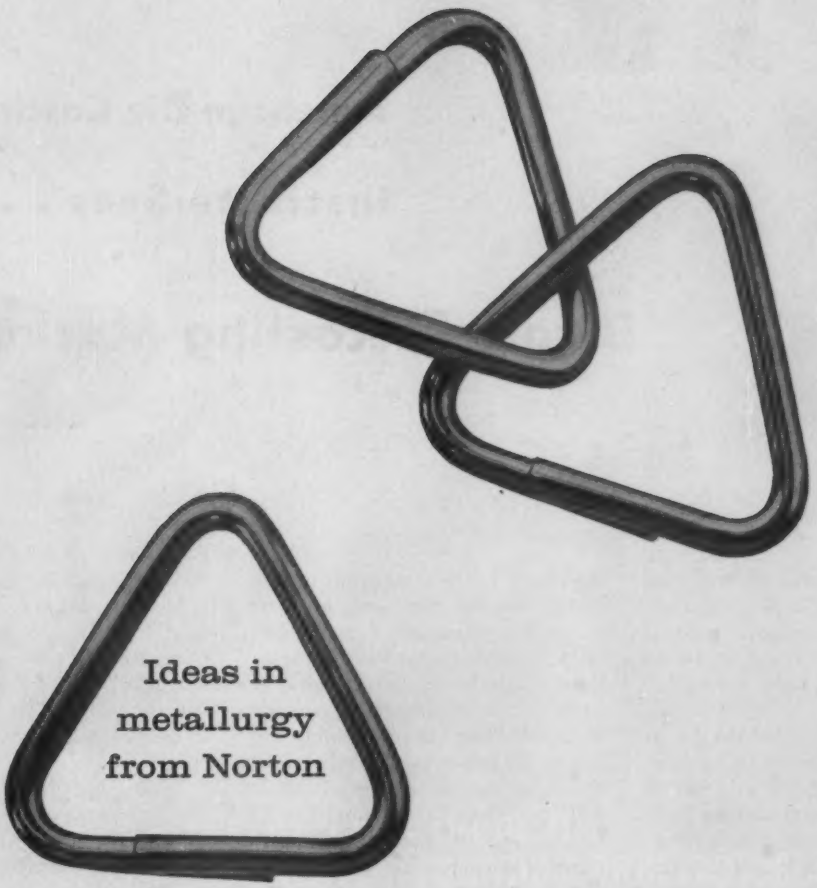

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For More Information Circle 673, Page 39

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Doehler Award

By JACK C. MISKE
Associate Editor

American Die Casting Institute Sees . . .

Bigger Diecasting Market

● 1962 will see production of aluminum diecastings at a record high level, and zinc diecasting output will approach the 350,000-ton level normal for a year of high automotive production.

That's the prediction of the American Die Casting Institute, national association of custom diecasters, which held its annual meeting Sept. 27-28 at the Edgewater Beach Hotel, Chicago. The ADCI also predicts that over-all 1961 diecasting production will be only slightly below 1960 levels.

With most predictions for 1962 economic activity on the optimistic side, diecasters feel confident that they will share in the prosperity. Finally, with automobile production estimated at 6½ million cars, zinc diecasting consumption should be much improved.

Technical Reports Given — The two-day meeting was attended by nearly 400 diecasters and guests. The opening day was devoted to technical reports covering activities of the institute's research arm, the Die Casting Research Foundation.

The main areas discussed included the search for new materials to give longer life to dies and machine parts; an evaluation of new lubrication techniques to speed production through better understanding of mold release requirements; a study of metal flow in diecasting dies which is being conducted jointly with the American Zinc Institute and the American Foundrymen's Society; and the successful development of a compatible vacuum diecasting system.

The DCRF announced that each of its 120 member plants is eligible for a license covering production of diecastings by its vacuum method. Arrangements also are under study to provide a basis for licensing diecasters who are not ADCI member companies. The DCRF system is said to be readily utilizable with any existing die and diecasting machine.

The foundation's method reportedly permits continuous massive evacuation of the die cavity until it is filled compietely with metal. No valve is used in the vacuum passage, and direct, continuous vacuum level measurement in the cavity throughout the casting cycle is possible. Massive venting can be used without vacuum, or, where it is warranted, relatively high vacuum levels can be attained. Consistent, reproducible evacuation to 27.5 in. Hg is claimed to be practical.

Welcoming New Members—On the second day, R. E. Kellers, assistant secretary, ADCI, described how a new member is introduced to the institute's activities and programs such as the Certified Zinc Plan, Product Standards, technical committees, statistics on diecasting sales trends, safety data, wage rate surveys, marketing meetings, problem-casting clinics, and other functions.

Reports on regional group activities were made by the four group chairmen, who included W. P. Feil, Aluminum Co. of America, eastern group; Norman Dress, Precision Castings Co., division of Fulton Industries, central group; Fred Klement, West Irving Die Casting Co., midwestern group; and E. M. Woods, Aluminum Die Casting Co., Pacific Coast group.

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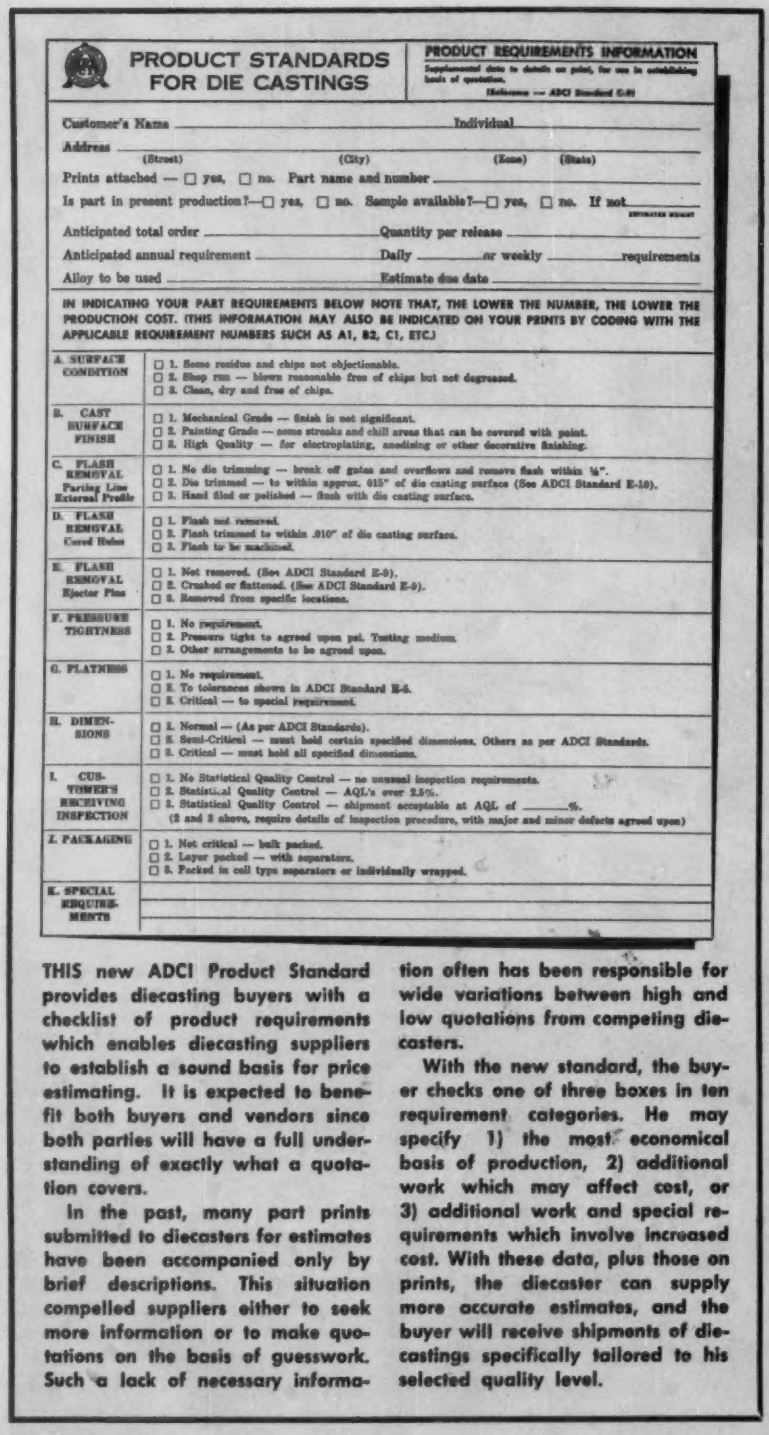

PRODUCT STANDARDS FOR DIE CASTINGS

PRODUCT REQUIREMENTS INFORMATION

Supplemental data to details on print, for use in establishing basis of quotation.

Reference — ADCI Standard G-01

Customer's Name _____ Individual _____

Address _____
(Street) (City) (Zone) (State)

Prints attached — ☐ yes, ☐ no. Part name and number _____

Is part in present production?—☐ yes, ☐ no. Sample available?—☐ yes, ☐ no. If not, estimate when _____

Anticipated total order _____ Quantity per release _____

Anticipated annual requirement _____ Daily _____ or weekly _____ requirements

Alloy to be used _____ Estimate due date _____

IN INDICATING YOUR PART REQUIREMENTS BELOW NOTE THAT, THE LOWER THE NUMBER, THE LOWER THE PRODUCTION COST. (THIS INFORMATION MAY ALSO BE INDICATED ON YOUR PRINTS BY CODING WITH THE APPLICABLE REQUIREMENT NUMBERS SUCH AS A1, B2, C1, ETC.)

A. SURFACE CONDITION	☐ 1. Some residue and chips not objectionable. ☐ 2. Shop run — blown reasonable free of chips but not degreased. ☐ 3. Clean, dry and free of chips.
B. CAST SURFACE FINISH	☐ 1. Mechanical Grade — finish is not significant. ☐ 2. Painting Grade — some streaks and chill areas that can be covered with paint. ☐ 3. High Quality — for electroplating, anodizing or other decorative finishing.
C. FLASH REMOVAL Parting Line External Profile	☐ 1. No die trimming — break off gates and overflows and remove flash within ⅛". ☐ 2. Die trimmed — to within approx. .015" of die casting surface (See ADCI Standard E-10). ☐ 3. Hand filed or polished — flush with die casting surface.
D. FLASH REMOVAL Cored Holes	☐ 1. Flash not removed. ☐ 2. Flash trimmed to within .010" of die casting surface. ☐ 3. Flash to be machined.
E. FLASH REMOVAL Ejector Pins	☐ 1. Not removed. (See ADCI Standard E-9). ☐ 2. Crushed or flattened. (See ADCI Standard E-9). ☐ 3. Removed from specific locations.
F. PRESSURE TIGHTNESS	☐ 1. No requirement. ☐ 2. Pressure tight to agreed upon psi. Testing medium. ☐ 3. Other arrangements to be agreed upon.
G. FLATNESS	☐ 1. No requirement. ☐ 2. To tolerances shown in ADCI Standard E-5. ☐ 3. Critical — to special requirement.
H. DIMENSIONS	☐ 1. Normal — (As per ADCI Standards). ☐ 2. Semi-Critical — must hold certain specified dimensions. Others as per ADCI Standards. ☐ 3. Critical — must hold all specified dimensions.
I. CUSTOMER'S RECEIVING INSPECTION	☐ 1. No Statistical Quality Control — no unusual inspection requirements. ☐ 2. Statistical Quality Control — AQL's over 2.5%. ☐ 3. Statistical Quality Control — shipment acceptable at AQL of _____%. (2 and 3 above, require details of inspection procedure, with major and minor defects agreed upon)
J. PACKAGING	☐ 1. Not critical — bulk packed. ☐ 2. Layer packed — with separators. ☐ 3. Packed in cell type separators or individually wrapped.
K. SPECIAL REQUIREMENTS	

THIS new ADCI Product Standard provides diecasting buyers with a checklist of product requirements which enables diecasting suppliers to establish a sound basis for price estimating. It is expected to benefit both buyers and vendors since both parties will have a full understanding of exactly what a quotation covers.

In the past, many part prints submitted to diecasters for estimates have been accompanied only by brief descriptions. This situation compelled suppliers either to seek more information or to make quotations on the basis of guesswork. Such a lack of necessary information often has been responsible for wide variations between high and low quotations from competing diecasters.

With the new standard, the buyer checks one of three boxes in ten requirement categories. He may specify 1) the most economical basis of production, 2) additional work which may affect cost, or 3) additional work and special requirements which involve increased cost. With these data, plus those on prints, the diecaster can supply more accurate estimates, and the buyer will receive shipments of diecastings specifically tailored to his selected quality level.

Metallurgical Committee — The metallurgical committee report was made by A. E. Weiss, Superior Die Casting Co., who announced that the committee is preparing a report on SC84A aluminum alloy, with 1 to 3 per cent zinc. A survey conducted on Zamak 7, the new zinc diecasting alloy, resulted in a suggestion that a footnote be added to to ASTM Specification AG40A stating that the magnesium content can be decreased when certain other alloying elements are present in specified quantities. This suggestion was rejected, and a further study will be made to lead to a new suggestion.

Mr. Weiss also reported that checks being made under the Certified Zinc Plan had shown a slight increase in off-analysis or contaminated samples. The institute now is considering forbidding use of the Certified Zinc symbol to any company which has two violations in one year.

Safety Program—Norman Dress, Precision Castings Co., chairman of the ADCI's national safety committee, pointed out that in addition to avoiding human suffering, safety saves cash by reducing accident insurance premiums and cutting lost production time. He concluded his remarks with a presentation of the institute's safety certificates of merit to the following companies:

Ability Die Casting Co., Chicago; Aluminum Die Casting Co., Los Angeles; Callen Mfg. Co., Maywood, Ill.; Century Die Casting Co., Chicago; Doehler-Jarvis Div., National Lead Co., Grand Rapids, Mich.; Future Products Co., Portland, Oreg.; C. M. Grey Industries Inc., East Orange, N. J.; Madison-Kipp Corp., Madison, Wis.; Midwest Die Casting Co., Milwaukee; Rangers Die Casting Co., Lynwood, Calif.; Stella Products Corp., Livingston, N. J.; Titan Metal Mfg. Co., division of Cerro Corp., Bellefonte, Pa.; and West Irving Die Casting Co., Bensenville, Ill.

Field representatives' reports were made by G. M. Rollason, eastern group; D. L. Glass, central group; H. C. Snyder, midwestern group; and J. M. Davis, Pacific Coast group. Each discussed his activities with the group he represented, and Mr. Rollason added some comments about the ADCI research effort. The institute's research budget is $110,000, he said, and the free effort devoted to the program by member companies and individuals can be calculated at enough to bring the annual expenditure for research up to perhaps $500,000. Even this figure, Mr. Rollason stated, is only one-fifteenth the general industrial average of 3 per cent of total industrial output.

Describing the institute's activities in behalf of its members, David Laine, secretary, ADCI, said that it speaks for the custom diecaster when it expresses the industry viewpoint to legislative and regulatory bodies, to the public, to supplying industries, and to other associations and

Circle 675, Page 39→

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Wilson's prompt service reduces costly down time, since a representative job is completed and shipped within five days after receipt . . . and in less time for emergencies.

Don't discard or scrap salvageable copper components. Restore them to full efficiency at a fraction of replacement cost. Write or call Wilson Welding Company, Inc. for cost estimate or additional information without obligation.

These two views of the same electrode holder show the badly burned and pitted condition in which it was received, and its appearance after restoration to original specifications by Wilson Welding's unique, exclusive process. This holder was shipped within five days after receipt at a cost less than half that of a new unit.

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societies. He also condemned "under-the-table discounts" by zinc and secondary aluminum suppliers. Such practices, he said, make it impossible to stabilize prices and win customer confidence.

Mr. Laine also struck at diecasters who make sales by cutting prices unreasonably. Price cutting, he stated, hurts everyone. Diecasters make no profit, quality is lowered, suppliers are not paid, discount pressure is increased, and capital investment and growth are impaired. Only reasonable profits can solve this problem and make possible economic survival of both suppliers and producers.

Insurance Program—G. W. Peterson and L. W. Hagerup, James S. Kemper Co., described a group compensation and accident insurance program under consideration by the institute. It would include help with educational and safety programs. The accident frequency rate in diecasting plants whose records are available is about 11½, whereas the over-all industry average is about 6½, they said. H. T. Walworth, director of industrial hygiene and occupational health for Kemper, also discussed the nature of a good industrial safety program.

Marketing Committee—The marketing committee's projected program was explained by H. W. Bollman, Newton-New Haven Co.; L. E. Capek, Du-Wel Metal Products Co.; W. F. Feil, Aluminum Co. of America; and R. A. Lawson, Monarch Aluminum Mfg. Co.

Mr. Bollman stated that the marketing committee is considering a national advertising program and also has investigated such possibilities as catalogs, telephone directories, and traveling clinic-type exhibits. He pointed out that the committee wants to help members sell castings at a reasonable profit. The industry was developed, Mr. Bollman said, on the basis of creative selling. Now, however, price fighting has replaced both creative selling and profits. He told diecasters to have the courage to refuse to bid against others at cut prices.

Mr. Capek explained the purpose and nature of the institute's new product standard, ADCI Standard C-91, which is designed to give both users and producers of diecastings a clear understanding of quality level desired and the cost of achieving it. See the accompanying box on p. 200.

Mr. Feil revealed that the committee will attempt to organize a speakers bureau and will prepare three speeches as bases for talks to be presented by member company representatives. One would be directed to purchasing groups, the second would show how the jobbing diecaster can help designers, and the third would provide basic diecasting information for engineers and operating personnel.

Mr. Lawson defined marketing as a combination of public relations, advertising, and selling. He outlined a public relations project for the institute which would operate through the regional groups. They would work with the marketing committee and a public relations committee under the co-ordination of ADCI headquarters.

Officers Elected—New officers of the institute include Walter E. Brown, vice president, Kiowa Corp., president, and W. G. Newton Jr.,

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president, Newton-New Haven Co., vice president.

Members of the national board of directors elected to three-year terms by the regional groups are Alfred Schneier Jr., Advance Pressure Castings Corp.; R. I. Kopper, Monarch Aluminum Mfg. Co.; R. C. Shirtum, St. Louis Diecasting Corp.; and Frank D. Yaussi, Ambrit Industries. W. N. Brammer, Precision Castings Co., was elected to the board to complete the unexpired term of A. D. Weigolt, recently retired from that company.

Mr. Brown and F. W. Burgie, Doehler-Jarvis Div., were re-elected directors-at-large for one-year terms. T. E. Coleman, Madison-Kipp Corp., and R. A. Peter, New Products Corp., were elected directors-at-large.

Chairmen of the regional groups are H. J. Marcks, C. M. Grey Industries, eastern group; G. E. Kaufman, Hoover Co., central group; Mr. Shirtum, midwestern group; and Mr. Yaussi, Pacific Coast group.

Doehler Award — The annual Doehler Award was presented to Alfred F. Bauer, manager, Doehler-Jarvis Div., in recognition of his outstanding contributions to the advancement of diecasting. These include his responsibility for the production of the first diecast aluminum engine block for an American automobile as well as his years of leadership in the custom diecasting industry.

Lillegren Awards — The Austin T. Lillegren Awards for 1961 went to Norman Dress for his outstanding service on the ADCI National Safety Committee, and to R. C. Cornell, Litemetal Dicast Inc., for his outstanding service on the Technical Committee of the DCRF.

PMM Scholarship Award — The Irving Hexter-Precision Metal Molding Magazine Memorial Award, a $350 scholarship, was made to Marshall R. Nathason, a senior at California State Polytechnic College.

Zinc Diecasting of Year — The New Jersey Zinc Co. award for the zinc diecasting of the year was presented to Hadlock & Temte, Chicago, for an elapsed time indicator which weighs less than half an ounce and is made up of 11 zinc diecastings. Nine awards of distinction also were made. For full details on the winning diecastings, see Page 143 of this issue.

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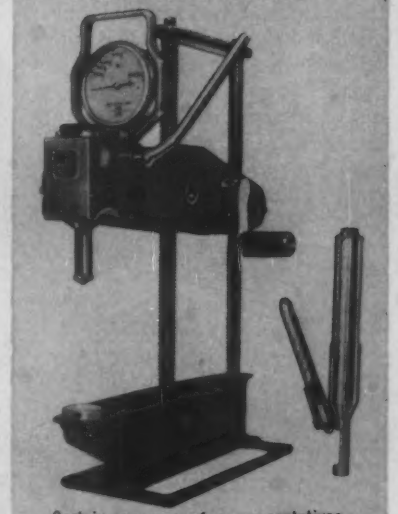

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For More Information Circle 677, Page 39

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For More Information Circle 678, Page 39

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At Eaton Manufacturing Company, Foundry Division, Vassar, Michigan, BAKELITE foundry resins are helping to produce more and better castings.

Gray iron pump bodies and covers are mass-produced from shell molds made with BAKELITE phenolic resin BRW-7151. Daily production has been greatly improved due to the faster mixing cycles possible with BRW-7151. Good resin flow properties ensure ideal shell weight pick-up and optimum green strength on pattern plates. Eaton has been able to produce more castings per ton of metal poured since rejects caused by poor shells have been greatly reduced. The excellent storage properties of BRW-7151 hot-coated sand allows Eaton to keep a constant supply of material for their conveyor casting operation.

If you're looking to improve shell molding performance why not check our BAKELITE foundry resins. Our foundry trained representative will be happy to discuss with you all the BAKELITE Brand Foundry Resins for shell and core molding. Call him now. Or write Dept. HC-52K, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada:* Union Carbide Canada Ltd., Toronto 12.

UNION CARBIDE PLASTICS

BAKELITE and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

PATENTS of INTEREST

Metal Fluidity Tester

Device for determining fluidity of molten metal comprises a length of small-bore glass or metal tubing curved at one end for insertion into the metal bath. Other end is attached to a vacuum tank through a quick-acting valve. In operation, the horizontal section of the tube is held level while the open end of the tube is inserted in the metal bath. The valve is opened, and the vacuum abruptly applied to the tube draws the molten metal into it for a definite distance depending on composition, solidification characteristics, vacuum applied, etc. *Patent No. 2,995,029 granted to D. V. Ragone and assigned to Harry W. Dietert Co.*

Casting Machine

Machine for centrifugal casting includes electrically heated furnace and a mold mounted on a bar arranged to rotate those units in a horizontal plane. Additionally the mold is arranged to rotate around its longitudinal axis. In operation, the metal is melted in the furnace, and when the desired temperature is reached, the rotating mechanism is placed in operation. That causes furnace and mold to spin in a horizontal plane, forcing the metal from the furnace into the mold. Simultaneously, the mold rotating on its horizontal axis distributes the metal into all parts of the mold cavity. *Patent No. 2,992,463 granted to H. R. Berger and assigned to J. F. Jelenko & Co., Inc.*

Shell Mold Binder

Formation of shell molds without excessive residue build-up on the patterns is claimed for an inexpensive binder composed of a blend of novolak and the reaction product of furfural and a thermoplastic lignin-type resin. The latter is a gasoline-insoluble wood resin which is mixed and coreacted with 8 to 10 per cent furfural. Forty per cent of this reaction product is mixed with the novolak and 8 to 18 per cent hexamethylenetetramine. Material may be mixed with sand in dry form or used in precoating sand in amounts from 3 to 7 per cent by weight. *Patent No. 2,997,759 granted to C. F. Froberger and assigned to General Motors Corp.*

Forms Passageways

Unlined passageways in magnesium and aluminum alloy castings are produced by use of soft copper or steel tubing of the desired size and bent to the proper contour or shape. The metal tubing is covered by drawing over it braided tubing of glass fibers or stainless steel. The covered tubing is located in the mold cavity, and the metal

poured around it. After completion the core or passageway forming material is removed by chemical and mechanical means.

For aluminum castings, glass fiber braid is preferred, and the metal portion of the tubing is removed by solution in nitric acid. Then the glass fiber tubing can be pulled out. In case of magnesium castings, a combination of nitric and hydrofluoric acids must be used to prevent undue corrosive attack on the magnesium. Preferably stainless steel braid is used in this case since glass fiber is attacked by the hydrofluoric acid, would have to be blown or washed out. *Patent No. 2,991,520 granted to R. F. Dalton and assigned to Howard Foundry Co.*

Induction Furnace

Prevention of refractory failure at the junction of side wall and bottom in low-frequency induction furnaces is accomplished by use of cooling coils free from alternating current power supply around the bottom. Cooling coils preferably have an electrical conductivity of about one-tenth that of copper. Similar nonpowered cooling coils are placed at the top section of the furnaces. Vertically extending yokes of magnetic material connected to inwardly projecting pole pieces at the tops and bottoms also are included in the construction. *Patent No. 2,997,512 granted to Mario Tama and assigned to Ajax Magnethermic Corp.*

Diecasting Machine

Safety device for diecasting machines which prevents operation on failure of ejection of casting from the die includes a sloping channel or chute into which the ejected casting falls. Channel contains a gate against which the casting comes to rest. Face of the gate is connected to one side of an electrical circuit and the channel to the other side. Casting forms connection between the two and places in operation electrical circuitry which elevates the gate, permitting the casting to leave the chute, and the diecasting machine to cycle. *Patent No. 2,994,115 granted to J. R. Schuchardt and assigned to Dollin Corp.*

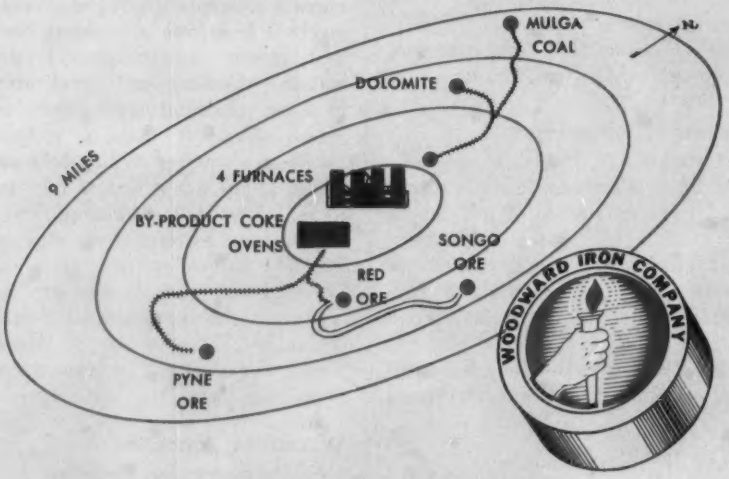
Casting Method

Production of rotors for squirrel cage electric induction motors is accomplished without difficulties encountered in other methods by use of an elastomer sleeve and a vacuum system. The sleeve of silicon rubbers is designed to fit tightly around the stacked laminations to prevent escape of metal through the exterior slots, and the lower flange of the sleeve is sealed to the base plate by a flanged chamber.

Top of the sleeve is connected to

WOODWARD PIG IRON

famous for Quality



The rich iron ore, the coal, and all the other essential raw materials are supplied by Woodward's mines and hauled direct to Woodward Furnaces and Coke Ovens by Woodward's own railroad.

Woodward's 70,000 acres of ore-rich land are in the heart of Alabama. Woodward Furnaces are within a "stone's throw" of shipping facilities, enjoying all year water transportation, as well as being in the center of rail terminals.

If you are not using Woodward Iron, Malleable, Basic, Foundry, High Phos, you are missing something. You are missing the superfine quality of the iron itself, the large number of analyses available, and — Hickman, Williams quick and efficient service.

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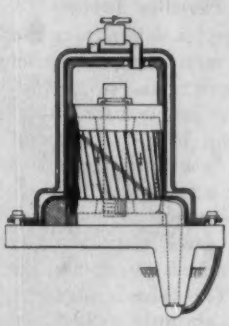
a vacuum system to evacuate the contained air. A nozzle attached to openings in the base holding the laminations extends down into a container holding the molten aluminum. End of the nozzle is fitted with a movable stopper. In operation the atmosphere in the sleeve is evacuated to about 5 mm



mercury, and then the stopper at the end of the nozzle is moved to permit the molten metal to be drawn up into the openings in the laminations. *Patent No.* 2,991,518 *granted to E. J. Schaefer.*

Malleable Iron

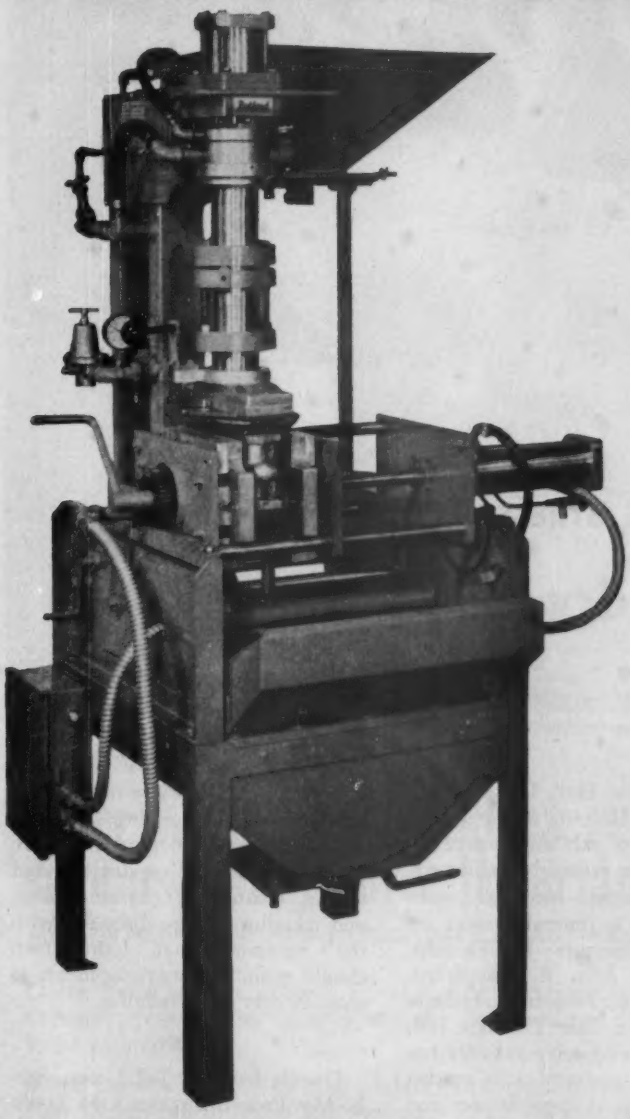
High-strength malleable iron contains preferably 2.10 per cent C, 1.40 per cent Si, 1.20 per cent Mn, 1.45 per cent Cu, and 0.60 per cent Zr. When subjected to heating at 1500° F, quenching at 350°, cooling, reheating to 840°, cooling, reheating to 1700° F and cooling to room temperature, the material shows a tensile strength of about 118,000 psi, a yield strength of 110,940 psi, and an elongation of 4 per cent. *Patent No.* 2,992,950 *granted to Lucien Peras and assigned to Regie Nationale des Usines Renault.*

Desulfurization

Method of desulfurizing ferrous metals involves treatment with molten caustic soda containing calcium carbide or manganese dioxide or both. Mixture may contain 90 per cent caustic and 10 per cent carbide or manganese dioxide, or 90 per cent caustic soda, 7 per cent manganese dioxide, and 3 per cent calcium carbide. Temperature of the molten material may range from 850 to 1100° F. It is injected into the molten bath from an insulated container. *Patent No.* 2,992,097 *granted to H. R. Spence.*

Redford

MODEL HP-4
SHELL CORE BLOWER



A very fast low cost machine that is setting new standards in the production of small shell cores. The quality of intricate shell cores is improved because sand is blown into core box cavities through unrestricted blow holes. A novel cradle-type core box clamp is used to invert the core box and at the same time bring the core box within easy reach of the operator for core removal. There is no out of balance weight to struggle with. The machine can handle core boxes up to 10" x 10" in size. Shell cores may weigh up to 4 lbs., before draining.

The HP-4 Redford has ample blow capacity and can also be used to blow Furfural resin sand mixes into heated core boxes.

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. . Above cores illustrate the variety of work that can be done with the Redford HP-4 Core Blower.

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For More Information Circle 681, Page 39

Close attention is shown by group at right to Speaker Jeff Green at an iron session. Left to right at banquet table below are: Mrs. Robert C. Kane; Gale Bullman, MSM head coach; Mrs. Curtis L. Wilson; Dane E. Smith, banquet speaker; Prof. Dan Eppelsheimer; Dean Curtis L. Wilson; Mrs. Bullman; Mrs. Eppelsheimer, and Robert C. Kane, chairman of the conference

MISSOURI CONFERENCE STRESSES

Practical Foundry Discussions

By ROBERT H. HERRMANN
Associate Editor

● TECHNICAL PAPERS slanted to the man in the shop were presented before a group of 200 at the Missouri Valley Regional Foundry Conference held Sept. 21-22 at University of Missouri, Rolla, Mo. The conference was sponsored by the university's School of Mines & Metallurgy and the Mo-Kan, St. Louis District, Tri-State, and MSM Student Chapters, American Foundrymen's Society.

Conference Chairman Robert C. Kane, Midvale Mining & Mfg. Co., St. Louis, opened the conference and introduced Dean Curtis L. Wilson who welcomed the conferees to the university.

In responding to the welcome, A. L. Hunt, AFS president, spoke of his many years association with MSM and of the fine job the university is doing in foundry education. He described plans for the AFS International Convention to be held at Cobo Hall, Detroit, May 7-11, 1962. Half of the available 100,000 sq ft of exhibition space already has been rented by exhibitors.

The technical meetings were opened with a general session on **New Developments in Foundry Practices** by John A. Rassenfoss, American Steel Foundries, Indiana Harbor Works, East Chicago, Ind. Since 1947 the foundry industry has lost about 30 per cent of its market through failure to apply science and technology and to develop sufficient new processes and products.

Five areas exist for improving the industry's status: 1. Market research to determine why castings are not specified oftener and how many might be sold if certain problems were licked. 2. Improve quality and reliability of castings. 3. Reduce cost, particularly labor cost. 4. Develop casting design data in suitable form and take it to designers. 5. Increase the rate of new process and product development.

Recent new developments in core and mold making, production and testing techniques, patternmaking, and metallurgy were discussed with the reminder that foundrymen should exploit new developments as soon as they are available.

IRON

Ductile Iron, by Jeff Green, Sorbo-Mat Process Engineers, St. Louis. The use of ductile iron is expanding, although not all design engineers accept the material wholeheartedly. Foundrymen must learn more about ductile iron properties and must use the proper production and control techniques to produce parts cast of the material.

Important factors which must be

Short Kostkutter Rod stub at left contrasts strikingly with wasted conventional cutting carbon stub at right—nearly three times as long.

"Speer KOSTKUTTER® RODS save us money three important ways,"

says Floyd Harbin, Cleaning Room Foreman, Commercial Steel Castings Co., Marion, Ohio

Check these very substantial benefits that Commercial Steel Castings Company derives from Speer Kostkutter Rods and ask if you can afford to be without them:

- **Rod savings** of close to 25%—interlocking feature permits joining rod stub to new rod in just a few seconds, drastically cutting stub wastage.
- **Time savings** of 12-18%—rods' interlocking design keeps torch at work more continuously, eliminates time-consuming sleeve-joining methods.
- **Torch life considerably increased** since heat is kept away from the clamp.

Concerned with getting maximum metal removal for every dollar expended on cutting carbons? Then you'll appreciate the time- and money-saving advantages of Kostkutter Rods. An exclusive product of Speer Carbon Company, they are available in diameters of ½", ⅝", ¾" and 1".

SPEER Carbon Co.
ST. MARYS, Pa.

JOY Limberoller® idlers outlast steel idlers ten to one in foundry operations

Conventional steel idlers have four bearings under the belt where they can clog up with foundry sand and "freeze," eventually causing ripped belts. Joy Limberoller belt conveyor idlers have just two bearings, one at either end, supporting a neoprene-covered steel wire cable. Neoprene discs are molded to the cable, and the swedged shank ends of the cable fit into bearings. The entire unit revolves on its own axis in these end-mounted bearings.

Spilled foundry sand can't possibly get into the bearings because they are up out of the dirt. The bearings may be of the permanently lubricated type so that inspection and greasing are eliminated entirely. Many foundries that have standardized on Joy Limberollers have removed them from their maintenance records. You can make a trial installation simply by putting Limberollers on your present conveyors . . . conversion is quick and easy. Get the complete story by writing for bulletin 2746-13.

JOY

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For More Information Circle 683, Page 39

controlled in ductile iron production are the base charges, melting atmosphere, base chemistries, and processing techniques. Proper control is hampered when ductile iron is produced with other metals in the same foundry. Techniques can become confused and scrap can be mixed.

Good castings depend on good gating and proper melting and metal handling. The iron should not be overtreated with nodulizing agents. Also, metal cleanliness is of more importance than with other ferrous metals. Fast pouring of ductile iron has been overemphasized. It is not necessary.

Marketing of Engineering Irons in the Midwest and Southwest, by Howard Randall, International Nickel Co., Houston. Several approaches to promoting the sale of castings were suggested. Foundry representatives must contact customer engineers as well as purchasing agents. Get buyers to specify by ASTM or other general specification and not by trade name.

Let your customers know how you test castings and if you will stand behind cast parts you sell. Be dependable in promised delivery dates. Promote the upgrading of cast part quality and reliability. Some foundries are too production minded at the expense of casting quality.

Get into customers' plants to go over drawings and parts buying and replacement schedules. Recommend design changes and the sale of new or replacement parts. Do not make exaggerated claims for your castings. Learn where customers are having trouble with castings and do a better job to reduce casting failures.

New Core and Mold Processes for the Iron Foundry, by Anton Dorfmueller Jr., Federal Foundry Supply Div., Archer-Daniels-Midland Co., Cleveland. During the past year two new sand binding processes have been introduced. The processes, involving the use of furan resins, are the self-curing binders used for large cores and molds and the hot-box binders used for high production of cores. Both processes use a furfuryl alcohol, urea formaldehyde co-polymer resin as the base binder which is catalyzed by phosphoric acid.

The characteristics, uses, and costs of these and seven other binders were discussed in detail.

Gating and Risering, by H. Otey Meriwether Jr., Lynchburg Foundry Co., Lynchburg, Va. Gating systems on high return jobs were studied to determine why they produced better castings than other systems. Formulas were developed from the data for determining pouring time, effective sprue height, choke area, runner size, and riser and riser connection sizes.

Application of these formulas for calculating gating systems on other jobs in the foundry has been successful in increasing the percentage of good castings produced.

The formulas are based on a constant dependent on section size of a casting. Value of the constant may differ slightly for different foundries, but generally the difference, if any, is small.

STEEL

Desulfurization of Steel, by B. G. Gray, Air Reduction Sales Co., New York. Desulfurization of steel may be achieved by control of sulfur input, removal of sulfur through slag metal reactions, and by direct introduction of a reagent into the molten steel to combine with the sulfur and remove it by levitation or volatilization.

The third method has considerable potential but has had limited production use. Laboratory and field test work on this process was discussed in detail.

Refractories for the Foundry Industry, by P. J. Lucido, Kaiser Aluminum & Chemical Co., Mexico, Mo. The mining, calcining, and grinding of clays was described. Refractory shapes are made by hand, dry pressing, and by forcing a stiff mud of clay through dies. The shapes then are burned in a kiln.

New Developments in Core and Mold Making for the Steel Foundry, by Victor M. Rowell, Archer-Daniels - Midland Co., Federal Foundry Supply Div., Cleveland. Recent developments in molding and coremaking processes have been in improved green sand, shell molds and cores, CO_2 process, air setting oil binders, and the chemically curing furfuryl alcohol base binders.

The use of fine silica sands of broad grain distribution, bonded with 8-10 per cent western bentonite, worked at low moisture and

Birth of a Gray Iron Casting—No. 3

MAKING AND CASTING PIG IRON

The birth of a "pig" is a spectacular event, even to an old-time blast furnace man who has watched it a thousand times. The molten iron—smelted in a blast furnace charged with iron ore, coke and limestone—is tapped into 75-ton ladles amid a blinding cascade of white-hot metal.

From the ladles, Neville Pig Iron is poured into a continuous two-strand casting machine, illustrated. One of the longest ever built, the Neville machine allows slower cooling, produces a superior grain structure.

These efficient facilities, coupled with the selection of high grade raw materials and the pride of skilled men in producing a better product, constantly assure you highest quality Neville Pig Iron for the production of superior gray iron castings.

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Neville Pig Iron and Neville Coke for the Foundry Trade

these CLEVELAND CHAPLET features

Open coil head!
Clean 4-way breakoff!
Staggered knitting nicks!

keep casting quality HIGH!
improve production and SAVE MONEY!

These sturdy open coil head chaplets make precision casting easier because they pack firmer . . . hold core position.

They leave no voids . . . and finally, they break off cleaner. What's more, they cost no more than ordinary plate heads.

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For More Information Circle 685, Page 39

rammed hard, has improved the quality of green sand steel castings. Air setting oil binders for molds and cores have been used with very good results.

The use of sodium silicate binders with silica sand and of phenol formaldehyde resin bonded shell molds and cores with zircon sand has been only moderately successful.

The furfuryl alcohol base binders have had varying degrees of success in steel foundries. Self-curing binders have been most successful. Moderate success has been enjoyed by the furfuryl alcohol-urea resin blends cured with an acid catalyst.

Hot-box binders, which are blends of furfuryl alcohol and urea resin, are best suited to high-speed production of small cores for which only limited demand exists in steel foundries.

Sand for Molding and Coremaking, by Thomas W. Seaton, American Silica Sand Co., Ottawa, Ill. Most sand problems are due to poor knowledge of fundamentals of sand technology. The fundamentals involve sieve analysis, sampling, grain shape and distribution, density and particle fit, and determination of clay content. These were discussed.

The sand to use in castings production depends on type of metal poured, size of castings produced, molding method, finish and dimensional tolerances required, and cost. The testing of sand mixes was discussed and emphasis placed on two important points of control, moisture and mulling time.

New theories and practices with sands and clays were covered as was the need for research, the sharing of knowledge and experience, and the need for concern with industry problems rather than with individual problems.

NONFERROUS

High-Quality Aluminum Castings, by Alan B. DeRoss, Kaiser Aluminum & Chemical Sales Inc., Chicago. Recent advancements in the production of high-purity, high-strength castings involve the use of alloys A356, 357, A357 and 359. Their basic purity is derived from the use of pure aluminum containing very little iron, and from the addition of high-quality silicon and magnesium.

Melting practices are controlled precisely and elements such as beryllium and titanium are used to furnish specific characteristics. Oil-bonded molding sands, furfuryl alcohol resin base binders for molds and cores, and the latest horizontal and vertical gating techniques are employed.

Heat treating techniques involve higher solution and aging temperatures to accomplish complete heat treatment of the materials, thus realizing the full strength potential of the alloys.

ABC's of Molding Sand Practice, by Clyde A. Sanders, American Colloid Co., Skokie, Ill. Scientific improvement in industry has placed increasing emphasis on the need for closer sand control for production of better castings. Synthetic sands now are used widely in nonferrous foundries. They can be adjusted to obtain the desired properties. Many so-called natural sands really are semisynthetic.

The difference between mixing and mulling was explained and the proper use of each outlined. The effects of various additives were covered. Considerable attention was paid to the importance of the interrelation of sand properties and the changes that occur in molding sand when any one property is altered.

Variations in molding sand properties affect the quality of the resultant casting. A number of the possible effects were discussed.

Control of Quality in the Brass Foundry, by Fred L. Riddell, H. Kramer & Co., Chicago. To maintain and improve casting quality, foundrymen must initiate and follow a program to control all phases of practices used in their foundries.

Factors having the greatest influence on the quality of copper-base alloy castings are: Casting design; raw material, including metal, melting fuel, refractories, and mold material; foundry practices, which involve melting and pouring, metal temperature, and gating and risering; equipment maintenance, and the human element.

New Developments in Core Practice, by Robert Jacoby, St. Louis Coke & Foundry Supply Co., St. Louis. The CO_2 process, shell, air setting, chemical curing, and furan hot-box methods of core production were described. Preparation of the sand mixes, their application,

COST-CUTTER

The only accurate way to measure your abrasive costs is to determine *cost per ton of castings cleaned—not* just cost per ton of abrasive.

Rotoblast Steel Shot and Grit clean castings at lower cost per ton than other abrasives. That is why Rotoblast Steel Abrasives are the fastest growing on the market today. *Sales volume has tripled in 3 years.*

Low phosphorus, low sulfur steel and a special heat-treating process make Rotoblast Steel Shot and Grit solid, tough and free of voids and hollows—that's why they can save you so much on cleaning costs.

For actual figures, write to: PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Maryland; Pangborn Canada Ltd., 47 Shaft Rd., Toronto (Rexdale), Canada;—*Manufacturers of Rotoblast® Steel Shot and Grit®; Blast Cleaning, Vibratory Finishing, Dust Control Equipment.*

Pangborn
OF HAGERSTOWN

ROTOBLAST
STEEL SHOT & GRIT

and advantages and disadvantages, and their properties and costs were discussed in detail.

The technical program was concluded with a general session for all groups on nondestructive testing. The session included demonstrations plus a short talk by Prof. Robert V. Wolf, Department of Metallurgical Engineering, MSM. A good casting is one without defects. Defects are discontinuities which are harmful only when they render the casting useless.

Major steps in nondestructive testing are the detection, location, identification, and evaluation of discontinuities. These steps may be taken on a sampling basis or 100 per cent basis.

Nondestructive testing methods currently in use include visual inspection, hardness testing, weighing, chemical analysis, radiological inspection, magnetic particle inspection, and ultrasonic inspection.

Jack H. Thompson, Bodine Pattern & Foundry Co., St. Louis, and chairman, Industrial Advisory Committee, MSM, spoke at one of the luncheons on **The Foundry Industry and Missouri School of Mines & Metallurgy.**

Students, the university, and industry benefit from college level educational programs. Students have improved opportunities for summer employment, Foundry Educational Foundation scholarships, and eventual permanent foundry employment.

Universities get to know foundry management people during the setting up of work programs and field trips. Industry benefits from the employment of students during summers and of graduate engineers for management and technical jobs.

IT SHRUGS OFF MOISTURE AND ABRASION THAT KILL OFF ORDINARY BELTS

Beat it with the most abrasive materials, heat it to 350°F., subject it to moist sand. Imperial Sahara®, the belt that's made for rugged foundry duty, still keeps giving you perfect day-in, day-out service long after other belts have experienced ply separation, cover peeling, and bucket bolt pull-out.

Imperial's special Innerlocked® construction of heavy-duty hard silver duck and exclusive impregnating compounds reduces "come and go" to a minimum.

Send for this brochure on Imperial's eight foundry belts and how they cut your costs.

You expect more from Imperial and you get more!

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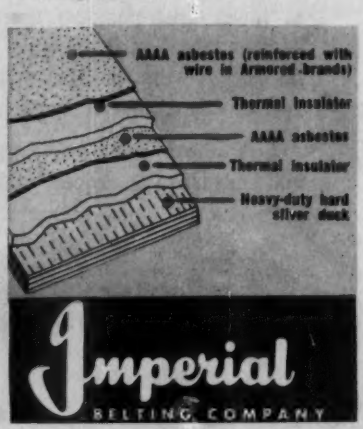
TAKES TEMPERATURES UP TO 600°F. AND KEEPS COMING BACK FOR MORE

Imperial Super Insulated Sahara® thrives on heat and abrasion that burn out other belts from 2 to 3 times sooner.

Unlike rubber belts (which vulcanize at 298°F.), Super Insulated Sahara® is specially constructed to take the heat. Two plys each of AAAA asbestos and exclusively developed thermal insulators guard the rugged base core of heavy-duty hard silver duck.

That's why it outlasts ordinary hot belting as much as 3 to 1 . . . gives you better performance, longer life, more value for every belting dollar.



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Howard C. Gollmar Honored For 50 Years of Service

Elyria Foundry Div., Chromalloy Corp., Elyria, Ohio, recently paid tribute to Howard C. Gollmar, executive vice president of the corporation and former general manager of the foundry, for 50 years of service. The occasion was a dinner which concluded a day-long program sponsored by the foundry for its customers. At the dinner, Mr. Gollmar was presented with a bound group of letters from some 70 friends praising his services in both the foundry field and in civic life.

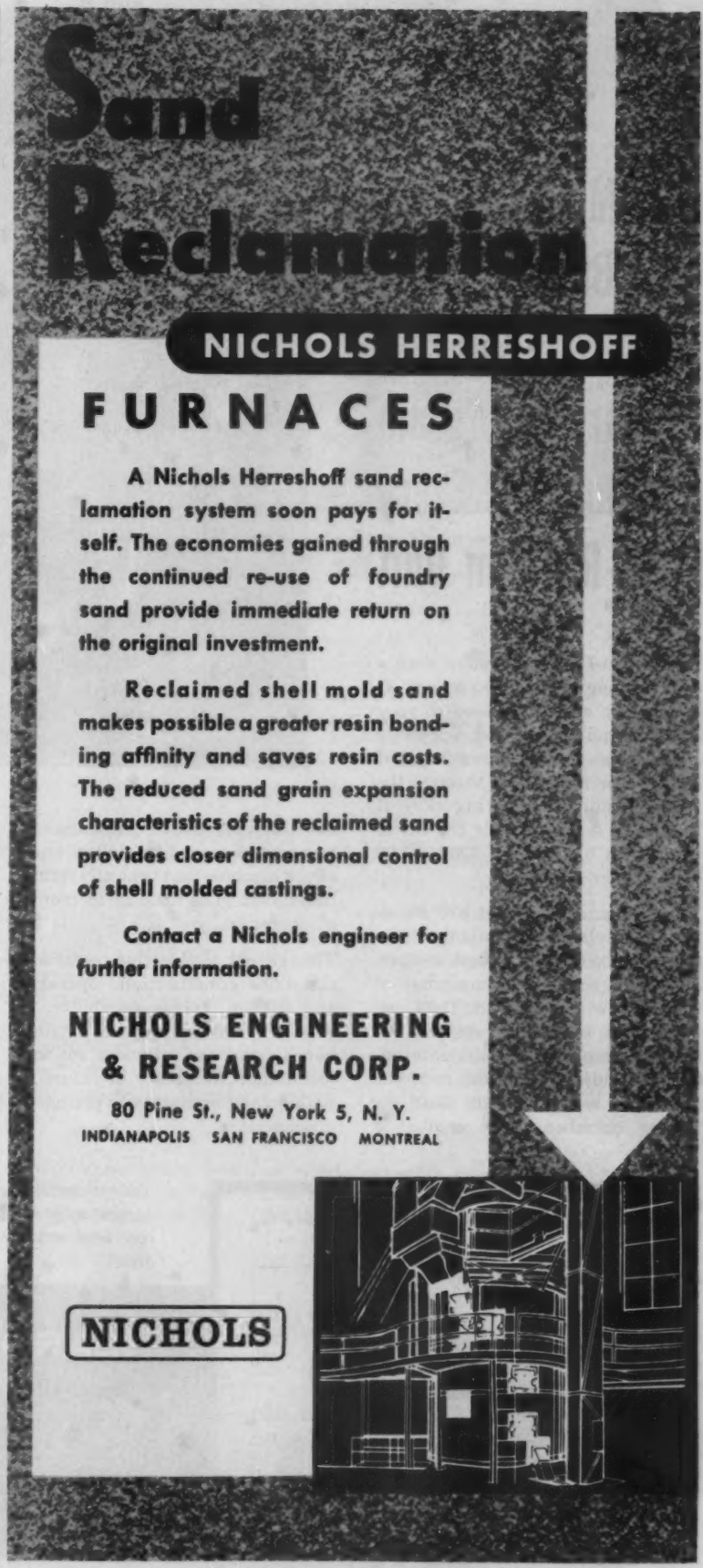
Mr. Gollmar began his service with the foundry in 1911 as an apprentice patternmaker. In succession, he held the positions of head of the patternmaking department, assistant general manager, general manager, and president. In 1957, when Chromalloy Corp. acquired the foundry as a division, Mr. Gollmar was made an executive vice president and director of the corporation. He relinquished his duties as general manager in 1959, but has continued to serve the company in the office of executive vice president.

In addition to extensive civic activities, Mr. Gollmar has participated actively in the American Foundrymen's Society. He served as chairman of the Northeastern Ohio Chapter, AFS, during the year 1947-48.

Offers Book on Safety Seminars

The National Safety Council is offering a booklet entitled "Talk Topics" which contains suggestions for foremen on how to conduct seminars on safety. The information provided enables a foreman to act as a discussion leader for a group of workers who are discussing and exchanging ideas on a particular safety subject. The booklet contains 96 pages, 6 x 9 in., and is filled with enough ideas so the foreman can conduct a long series of safety seminars.

Individual copies are $2.25 and there are special rates for quantity purchases. For additional information and prices, write to the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.


Sand Reclamation
NICHOLS HERRESHOFF
FURNACES
A Nichols Herreshoff sand reclamation system soon pays for itself. The economies gained through the continued re-use of foundry sand provide immediate return on the original investment.
Reclaimed shell mold sand makes possible a greater resin bonding affinity and saves resin costs. The reduced sand grain expansion characteristics of the reclaimed sand provides closer dimensional control of shell molded castings.
Contact a Nichols engineer for further information.
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INDIANAPOLIS SAN FRANCISCO MONTREAL
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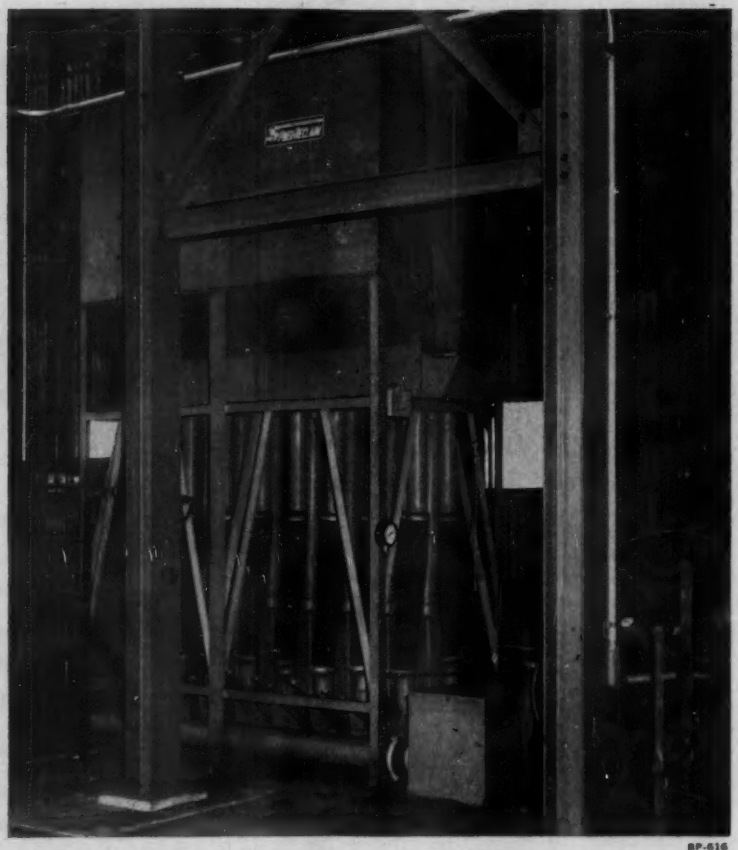
For More Information Circle 689, Page 39

From B&P RESEARCH

The Money-Saving Benefits of a $200,000 Research Program Go With Every Pneu-Reclaim Unit



BP-616

Your Pneu-Reclaim is more than a dollar-saving unit of equipment. It is part of a system tailored to your specific requirements and represents a new concept of reclamation that could be perfected only through the research and engineering skill of Beardsley & Piper. It is the direct result of a 5 year . . . $200,000.00 development program.

That program has paid off. Pneu-Reclaim reclamation units now represent the simplest, easiest-to-operate, most economical machines of their type ever marketed. The time, effort and technology required to achieve simplicity, to eliminate undesirable adjustments and controls, to secure self-adjusting sand/air mixing chambers have created a machine that can be relied upon to save you thousands of dollars annually; a machine that typically returns initial cost in as little as 15 months of operation.

Though not visible this technology simplifies construction, operation and control, boosts durability, increases efficiency, reduces maintenance costs and provides for easy installation, flexibility of future expansion and immunity to premature obsolescence.

The future of the foundry industry is dependent upon the research and development being done today. Our investment in our Technical Center where Pneu-Reclaim and other product testing is constantly underway; our research and development on both old and new products; our employment of top-flight engineers and technicians . . . all are essential to provide foundries with the best possible products at the lowest possible cost . . . now and in the future.

PNEU-RECLAIM Technology provides these Typical Savings in a Steel Foundry Reclaiming Sand For Reuse In Mold-Facing Mixtures.

Cost of purchased new sand from pit through foundry to dump, per ton (typical)	$7.28
Typical combined power and maintenance costs per ton reclaimed for reuse in mold-facing mixtures	.30
Typical savings on each ton reclaimed and reused in lieu of purchased sand, per ton	$6.98
Typical savings per month (250 ton)	$1,745.00
Total cost of complete 2 compartment Pneu-Reclaim system (installed)	approx. $25,000.00
Initial investment recovered in as little as	15 months

Your Beardsley & Piper representative is ready to suggest ways in which B&P research and engineering can best serve you. Contact him today, or write directly to:

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FEMA

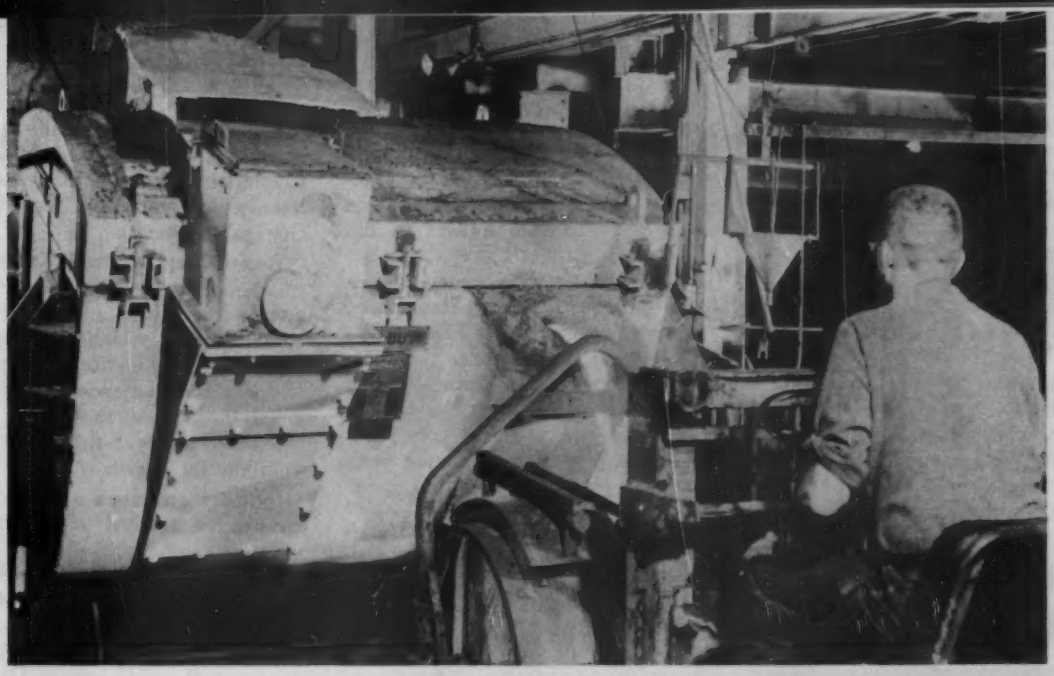


Fig. 1—Forehearth installed at Sibley Machine & Foundry Corp. tilts to pour gray iron into a ladle on a lift truck for transport to the mold conveyor line

Induction Forehearth Duplexing Improves Iron Properties

By ROBERT H. HERRMANN
Associate Editor

● IMPROVED tensile and transverse strengths have been obtained in cupola-melted iron duplexed in a low-frequency induction forehearth recently installed at Sibley Machine & Foundry Co., South Bend, Ind.

The improvement is such that a Class 20 iron from the cupola is raised to a Class 30 iron with no inoculation or treatment other than refinement in the induction forehearth.

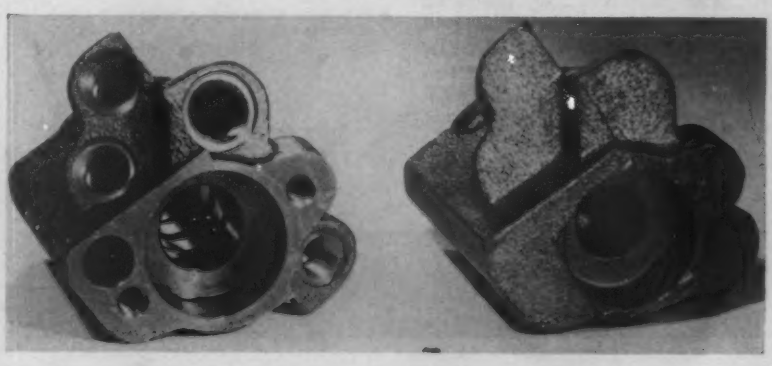
The duplexed iron is well-homogenized, tight-grained, and has flake graphite structure smaller than that in untreated iron. Buyers of castings produced from the refined iron report that the material has good machinability and consistent quality of a higher level than that generally obtained in unrefined iron.

In describing the new installation, Frank H. Reuwer, Sibley foundry manager, said that analyses of the refined iron since the forehearth was installed on Aug. 3 still are in the first stage of a continuing testing program. Continued testing is desirable so that the effect of operating variables on the metal quality can be compiled over a longer period of time.

That period may be longer than customary because of an unusual circumstance which put the induction forehearth into immediate production to supply iron for a special casting order from Bendix Aviation Corp. Since that casting order still is in production, no time has been available for the preliminary test runs customary with a new installation.

The Bendix order was for hydraulic valve bodies. Specifications called for a tight-grained, Type A graphite iron with predominately pearlitic structure. The castings

Fig. 2—Valve bodies were cast of iron refined in the forehearth. Specifications called for Type A graphite iron with an easily machinable, predominantly pearlitic structure. View shows valves after and before machining



had to be easily machinable.

Sample castings were submitted from the first heat of metal produced in the new forehearth. They were accepted with the request that the production castings be only of this quality iron.

The iron for that job is produced by supplying eutectic iron from the cupola to the forehearth where it is converted into hypoeutectic iron by the addition of steel. This ability to make comparatively easy adjustments in metal composition to meet special casting orders illustrates an advantage of the low-frequency induction forehearth. Practically no loss of alloys occurs when they are added to a heat in the forehearth.

The 4-ton low-frequency, induction forehearth is manufactured and sold by Hevi-Duty Electric Co., Watertown, Wis., under a licensing agreement with Forni Elettrici A. Tagliaferri of Milan, Italy. The unique arrangement of core, coil, and channels in combination with the low-frequency current in this forehearth is said to result in a controlled stirring action that produces homogenized metal with good mechanical properties.

Because rapid agitation is avoided, the metal surface is not broken, and the tight furnace cover excludes air that causes oxidation. The slag cover is kept fluid to allow gas to escape. A teapot spout which taps metal from below the surface contributes to purity of the iron poured from the forehearth.

Industry pressure for a practical, inexpensive method of improving the quality of iron and other metals led to the licensing agreement for the Tagliaferri furnace, according to Elton E. Staples, Hevi-Duty president. An additional factor is the trend toward increased foundry usage of induction furnaces as reported by FOUNDRY, May 1960, pp. 142-143.

From the management point of view, John E. McIntyre, Sibley president, sees the induction forehearth as offering an over-all improved quality iron, possible savings in operating costs by combining present melting operations of two cupolas into that of one cupola, and increased flexibility of operation and variety of product by being able to pour different types of iron at the same time, one directly from the cupola and treated iron from the forehearth.

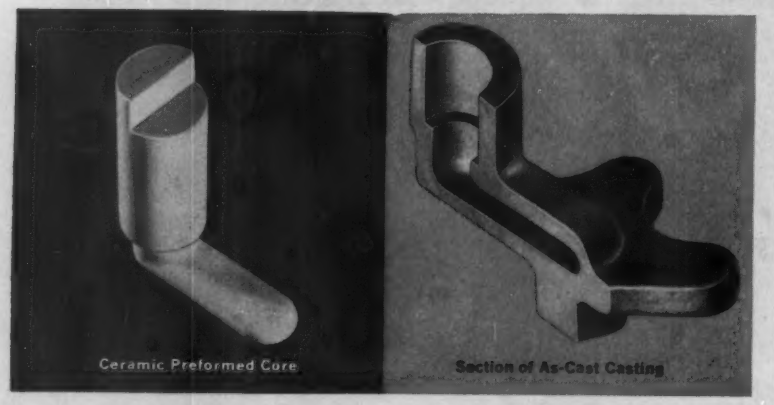
Book Review

***The BCAS Technical Reference Book of Compressed Air Terms and Standards*, 113 pages, 8½ x 11 in., published by the British Compressed Air Society, 32 Victoria St., London, SW 1, England. Price 30/-.**

Publication is a reference work on British practice in the selection, installation, testing, utilization, and maintenance of compressed air equipment. Range of equipment covered includes compressors, pneumatic tools, spraying plants, pneumatic control equipment, and accessories. Other subjects to which detailed reference is made are terminology and standards.

Over fifty special graphs and tables, relating to compressed air and gases, pneumatic tools, pneumatic control equipment, moisture content of air, and friction losses are included.

Eliminates Internal Machining . . . Increases Casting Yields



SHERWOOD Ceramic Preformed Cores Assure Smooth Internal Surfaces; Close-Tolerance Intricate Passages

This stabilized Sherwood core, inspected for accuracy and surface uniformity, solved a problem inherent in blind-hole design and production. The length and configuration of the small passage made conventional processing impossible. The manufacturer produced this casting without internal blisters, voids or other defects. Although the production run was small, the yield was 100% —proof of the reliability of Sherwood preformed ceramic cores for intricate design application.

- Hold internal tolerances within ±.005" or closer depending on size or configuration
- Produce as-cast internal surfaces of 100 RMS or better
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- Resist thermal shock without warping or fracture
- Eliminate metal/core reaction with any alloy
- Assure complete design freedom in size or configuration

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The new 1961-62 edition of PFL published by FOUNDRY magazine is now available. This directory gives comprehensive information on all the 5,879 metal casting plants in the U. S. and Canada (including die casters). It tells who they are and where they are located; what metals they cast, their melting equipment capacities, departments operated, etc.

Well-indexed, and in loose-leaf form, PFL is indispensable to casting buyers and foundry suppliers.

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NAME OF COMPANY _____

STREET ADDRESS _____

CITY _____ ZONE _____ STATE _____

For More Information Circle 692, Page 39

MEN of INDUSTRY

CHARLES C. GATES JR.
. . . Gates Rubber pres.

JOHN W. THORNTON
. . . Joy v. p.

ROY A. JACOBSEN
. . . Carondelet v. p. retires

CHARLES R. YOH
. . . joins GIFS staff

ROBERT S. MADDOX
. . . joins Foundry

Charles C. Gates Jr. has been elected president, Gates Rubber Co., Denver, succeeding his late father, founder and first president of the company. He joined the company in 1946 and became executive vice president in 1958.

John W. Thornton has been elected vice president and general manager, Industrial Div., Joy Mfg. Co., Pittsburgh. He joined Joy in 1957 and recently was vice president, marketing.

Kenneth F. Koegler has been named assistant to division manager, Doehler-Jarvis Div., National Lead Co., Toledo, Ohio. He joined the company in 1950 and most recently was a plant manager. **John W. Thees**, formerly division production manager, has been made plant manager of Toledo Plant 2. Mr. Thees joined the company in 1929.

William B. Bernstrom has been elected a vice president of Briel Industries Inc., Shelbyville, Ky. He joined Briel in 1959 and recently was in charge of sales for the foundry alloys and diecasting divisions. He is also a company director.

Roy A. Jacobsen, vice president, Carondelet Foundry Co., St. Louis, has retired after more than 30 years of service to the company. He also was an officer and director for the last 20 years. Mr. Jacobsen served as foundry and pattern apprentice in 1901 at George Fritz Co., started his own pattern business, and later was manager of Commercial Foundry and Green Foundry, both of St. Louis. He joined Carondelet in 1931.

Charles R. Yoh has joined the Gray Iron Founders' Society, Cleveland, as assistant to the technical director. Graduated from Cornell University in 1959, he was recently with National Castings Co., Cleveland.

James W. Klein has joined Oil City Iron Works, Corsicana, Tex., as assistant superintendent. He formerly was with Central Foundry Co., Holt, Ala.

H. Hayward Dinneen has been named general manager, Rust Furnace Co., Pittsburgh, replacing **Frank A. Blaine**, who has resigned. He had been chief engineer since 1951.

Andrew Gawura has been named manufacturing head, tablet division, Walter E. Kutch Co., Detroit. Mr. Gawura also is owner of Bronze-Craft and Mercury Pattern Works.

Bailey R. Day, formerly vice president in charge of production, Moline Iron Works, Moline, Ill., has joined Iowa Malleable Iron Co., Fairfield, Iowa, as works manager. **E. E. Zimmerman**, superintendent, has been made assistant general manager, and **Donald Reid** has been appointed comptroller.

Robert S. Maddox has joined FOUNDRY as district sales manager with headquarters in Cleveland. His territory will include parts of Cleveland and northeastern Ohio, western Pennsylvania, and western New York. **Kenneth L. Mountain**, district sales manager with headquarters in Cleveland, will continue to cover parts of Cleveland, the remainder of Ohio with the exception of the Toledo district, and central Indiana. After graduation from Miami University, Oxford, Ohio, Mr. Maddox worked for the Willard Storage Battery Co., Cleveland. He joined the Penton Publishing Co. in 1955 as district sales manager for *Automation* in New York. He became director of marketing services, *Steel*, in January, 1961.

Will Mitchell Jr. has been appointed director, research division, Allis-Chalmers Mfg. Co., Milwaukee. He joined the company in 1947 and recently was acting director of the division.

Karl H. Presser has been named president, Buckeye Foundry Co., Cincinnati, succeeding **William Gilbert Jr.**, who is retiring. Mr. Presser joined the company in 1958 after serving as director of research and development and manager of quality control at Forest City Foundries Co., Cleveland. Also retiring are **Charles E. Gilbert**, vice president, and **R. J. Redmond**, secretary-treasurer. **Harry Harymeyer** becomes vice president in charge of opera-

Ajax Broke the High Temperature Barrier 31 Years Ago

GRAPHITE VAPOR – 3600° C.

The Ajax-Northrup Coreless Induction furnace has allowed industry to extend its temperature possibilities in large controlled chambers far beyond the limits heretofore available. The set-up here shown was used successfully to vaporize graphite at 3600° C., and was maintained at a temperature well above 3000° C. for a period which apparently could be extended indefinitely

January 31, 1930

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TRENTON DIVISION 930 Lower Ferry Road • Trenton 5, New Jersey
YOUNGSTOWN DIVISION 3990 Simon Road • Youngstown 12, Ohio
AJAX MAGNETHERMIC, CANADA, LTD. Box 779 • Ajax, Ontario

RICHARD E. McCOACH
. . . sales mgr.

IRWIN SEDBERRY

BYRON L. BRENNAN
. . . abrasive specialists, Bay State

ROBERT F. MORGAN
. . . joins Pangborn sales

J. A. LOMBARDI
. . . sales engineer

tions; **John Metz** vice president, customer contacts and sales; **Helen Redmond** secretary-treasurer, and **Clara Niemeyer** assistant secretary.

Richard E. McCoach has been appointed manager of industrial sales, American Hoist & Derrick Co., St. Paul. He formerly had been general sales manager, Industrial Brownhoist Corp., Bay City, Mich.

Curt Searight has been appointed regional sales manager, Kaiser Refractories Div., Kaiser Aluminum & Chemical Corp., Oakland, Calif. He will have headquarters at Mexico, Mo. **Loyd Brinkman**, salesman, succeeds Mr. Searight as St. Louis district manager.

Herbert L. Ebner has been appointed Detroit district manager, Alter Co., Davenport, Iowa. Mr. Ebner will have offices at 19250 James Couzens Highway, Detroit.

Byron L. Brennan has joined Bay State Abrasive Products Co., Westboro, Mass., as abrasive specialist in Colorado, Kansas, Nebraska, and parts of Iowa, Missouri, South Dakota, and Wyoming. Previously he was with Behr-Manning Co., Division of Norton Co., Troy, N. Y. **Irwin Sedberry** has been named abrasive specialist for the central part of Indiana. He had been associated with Avels Sales and Engineering Corp., Olin Mathieson Chemical Corp., New York, and F. H. Langsenkamp Co., Indianapolis.

Joseph D. Stank has been elected vice president, Ladendorf Co., Detroit. The company represents Casting Engineers, Chicago, in the Detroit area. Mr. Stank joined Ladendorf in 1960 as sales engineer.

Richard L. Chapman has been made chief of the newly created Detroit office of Copper & Brass Research Association, New York, and will have temporary headquarters at 19730 Ralston St., Detroit. Formerly he was assistant chief engineer, basic science research, Chrysler Corp., Detroit.

Malcolm Hunt has been made assistant to the president, Macklin Co., Jackson, Mich. Previously he was vice president and director of sales. **Jack Arnst**, sales manager, has been made director of sales, and **W. L. Wolfe** has joined the company as Indianapolis area sales representative.

Robert F. Morgan has joined Pangborn Corp., Hagerstown, Md., as a member of the Detroit sales staff. He had been associated with Roberts & Schaeffer, Chicago; Sturtevant Div., Westinghouse Electric Co., Boston; Wheelabrator Corp., Mishawaka,, Ind., and Joy Mfg. Co., Pittsburgh.

J. A. Lombardi has been named engineer-sales, National Alloy Div., Blaw-Knox Co., Pittsburgh. Previously he was project engineer, Swindell-Dressler Corp., Pittsburgh, and line engineer, industrial heating department, General Electric Co., Shelbyville, Ind.

Charles D. Wright has been made southern regional manager, Air Filter Div., American Air Filter Co. Inc., Louisville, Ky. He will have offices in Atlanta.

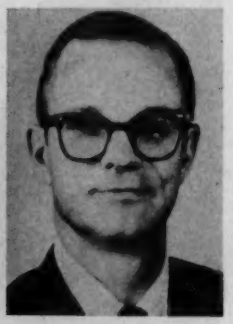
Robert E. Morken has been appointed product manager in charge of melting furnace engineering and sales, Hevi-Duty Electric Co., Watertown, Wis., division of Basic

HERBERT L. EBNER
. . . district mgr., Alter

W. L. WOLFE

MALCOLM HUNT
. . . Macklin Co. changes

JACK ARNST



ROBERT E. MORKEN
. . . product manager

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FECO'S patented "Multi-Bladed" impeller, adjustable for wear, projects a continuous, uniform "RIBBON OF SAND" in a continuous positive vertical throw. This hard-ram sand projection assures more uniform density—smoother molds—better castings. Action is vibration free, handling is easier, with less fatigue . . . less wear and tear on equipment.

FECO sandrammers are available in a vast range of models and capacities and for manual, semi-automatic, and automatic operation. They may be integrated into your present plant, or installed as part of a complete FECO foundry production line.

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Company .....

Address .....

EUGENE O'CONNOR
. . . becomes president

JOHN J. BRADLEY

ALFRED B. SCHACHTE JR.
. . . appointments at Link-Belt Co.

HARRY M. HORTON

EARL JACKSON
. . . sales representative

Products Corp., Milwaukee. For the last 17 years he was consultant on heat treating and metal melting, Chrysler Corp., Detroit.

Eugene O'Connor has been named president of the newly formed O'Connor Supply Co., 584 Grant St., Buffalo. **Paul A. Perry**, formerly sales manager, Smith-West Corp., Buffalo, has been named general sales manager. The new company succeeds O'Connor Abrasive Sales Co., also of Buffalo.

Hugh O. West has joined Cleco Air Tools, division of Reed Roller Bit Co., Houston, as a member of the company's Dallas sales office. He was formerly with Southwestern Oil & Refining Co., Corpus Christi, Tex. **Robert C. Spott**, formerly with Bell Telephone Laboratories, has joined the Newark, N. J., sales office. **Charles McClanaham** will work in the San Francisco bay area through the Burlingame office, and **Dudley Gang** joins the Toledo, Ohio, branch office.

Don H. Taylor has joined Wheelabrator Corp., Mishawaka, Ind., as regional engineer for nothern Ohio and Michigan. He formerly served as mechanical engineer, plant layout section, Ford Motor Co., Brookpark, Ohio. Mr. Taylor will have headquarters at Wheelabrator's Cleveland regional office.

Harry M. Horton has been appointed sales manager, Philadelphia plant, Link-Belt Co., Chicago, succeeding the late **James H. Oakes. Alfred B. Schachte Jr.**, formerly Pittsburgh district sales engineer, has been named assistant sales manager. **John J. Bradley**, formerly Boston district sales engineer, succeeds Mr. Horton as district manager, Summit, N. J.

Daniel E. Lucas has been appointed eastern regional sales-service manager, Industrial Div., Corn Products Sales Co., New York, replacing **Clyde D. Woodburn**, recently made manager of the Philadelphia district office. Mr. Lucas formerly was manager of the company technical service department, Argo, Ill.

James B. Johnson, supervisor of the core department, Hamilton Foundry Inc., Hamilton, Ohio, recently was named "Safety Foreman of the Year" and received a trophy from the Hamilton Safety Council. Mr. Johnson has never personally suffered a lost-time injury nor has any employee directly under his supervision during his 25 years as foreman.

Earl Jackson has been promoted to sales representative, Supply Div., Milwaukee Chaplet & Supply Corp., Milwaukee. He formerly was office manager.

Henry Welsch Jr., former sales manager, Vollrath Co., Foundry Div., Sheboygan, Wis., now is associated with Lough Brothers, foundry representatives, South Orange, N. J.

Ralph W. Walker has been appointed sales engineer, WaiMet Alloys Co., division of Howe Sound Co., Dearborn, Mich. Previously he was foundry superintendent, Northern Precision Casting Co.

Douglas R. Nichols Jr. has been elected executive vice president, Nichols Engineering & Research Corp., New York. He will also serve as director and president of Nichols Engineering & Research Corp. of

DON H. TAYLOR
. . . joins Wheelabrator

DANIEL E. LUCAS
. . . sales-service mgr.

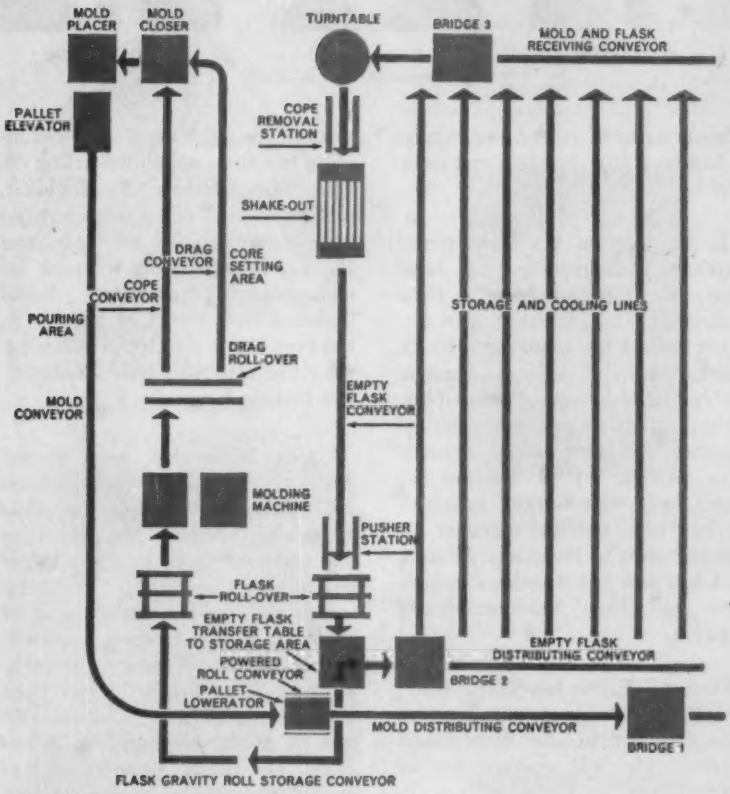
JAMES B. JOHNSON
. . . receives safety award

RALPH W. WALKER
. . . WaiMet sales

DOUGLAS R. NICHOLS JR.
. . . executive v. p.

New foundry installation by Link-Belt features

automatic mold and flask handling!



Unique storage and cooling lines permit prescription cooling for proper casting strength

Here you see the new, highly-efficient automatic mold-and-flask handling system recently installed by Link-Belt at a major midwestern foundry. From molding machine to shakeout, Link-Belt equipment smoothly integrates each successive operation. Seven storage and cooling lines accommodate the molds during their cooling period. Each mold arrives automatically and is reclaimed on schedule, precisely programed by a central console operating automatic traveling transfer bridges.

While your automatic mold handling system is still in its planning stage, a Link-Belt foundry engineer will be glad to consult with you in laying out and designing automatic equipment to meet your specific demands. Call your Link-Belt office and arrange for a meeting today. 15,000

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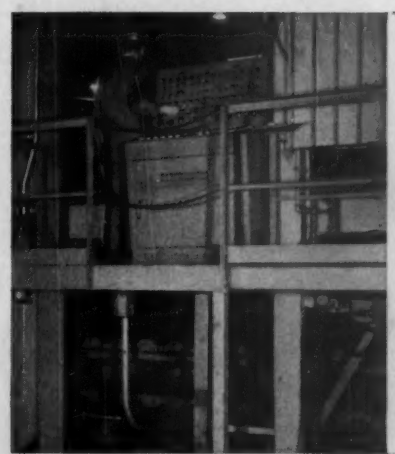
LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses and District Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs; Switzerland, Geneva. Representatives Throughout the World.



PROGRAMING From central control console, operator preprograms delivery and recovery of molds from cooling lines.

COOLING Seven lines, serviced by Link-Belt traveling bridges, store molds during cooling period.

SHAKEOUT Link-Belt equipment speeds final shakeout . . . then returns flasks to molding machine to repeat their cycle.

Cut Your Costs And Save Your Patterns With Arrow Butts And Peins . . . featuring replaceable rubber tips.

Over one half million have been used with complete satisfaction. Send for catalog on complete line of butts and peins. We feature 13 types. Sand rammer butts are our business, not our sideline.

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getting you down?

let us help you . . .

- ***find hidden cracks*** with magnetic particle or dye penetrant inspection equipment
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call any local Picker office
where a technical expert is always near (see 'phone book) or write

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E. W. CLAYTON

E. G. CLARK
. . . changes at Cleco Air Tools

J. G. HUDSON

Canada Ltd., Montreal. He formerly had been vice president and treasurer.

E. W. Clayton has been named director of marketing and sales, Cleco Air Tools, division of Reed Roller Bit Co., Houston. He formerly was sales manager. **E. G. Clark**, formerly regional manager for Newark, Detroit, Philadelphia, Pittsburgh, Cleveland and Chicago divisions, has been named domestic sales manager. **J. G. Hudson** has been made distribution manager. He had been regional manager for the company's Houston, Atlanta, St. Louis and Los Angeles divisions. Each will have headquarters in Houston.

Davis G. Taylor has joined Pangborn Corp., Hagerstown, Md., as sales engineer in the West Coast district. He will operate out of Alamo, Calif.

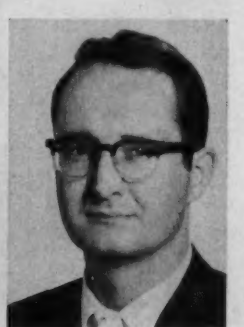
B. Nevling Clune has been appointed vice president and general manager, scale division, Fairbanks, Morse & Co., Yonkers, N. Y. Recently he was assistant general manager in charge of the division. **Harold E. Bosley**, formerly mid-western scale sales manager in Chicago, has been appointed acting division sales manager. **A. B. Parker**, western district office manager, has been made product manager, and **M. L. Frost**, former director of management engineering, Royal McBee Corp., Port Chester, N. Y., has been made director of planning. All three men will have headquarters in Fair Lawn, N. J.

Galen Miller has been elected president, Towmotor Corp., Cleveland. **Robert L. Fairbank**, vice president sales, succeeds Mr. Miller as executive vice president. **C. Edgar Smith**, president since 1951, assumes the newly created post of chairman of the executive committee. **Daniel M. Wessman**, formerly assistant sales manager, has been made executive vice president. **Alfred H. Roth**, in charge of advertising and sales promotion, was named manager of marketing and advertising, and **W. L. Utley** becomes assistant to the president, in addition to his position as assistant secretary.

Robert G. Patrick has joined C & S Products Co. Inc., DeKalb, Ill., as sales manager. Mr. Patrick

DAVIS G. TAYLOR
. . . Pangborn sales

G. F. RITTER



ROBERT G. PATRICK
. . . C & S appointments

POUR SLAG-FREE CASTINGS

MAKE A TEAPOT SPOUT LADLE FROM ANY BULL LADLE WITH

IRONTON L.P. TILE

Get bottom-pouring advantages at low cost with Ladle Pouring Tile. Just press in or embed in green lining of the ladle; dry as usual. Sizes 6" to 28" long for 50 to 4000 pound ladles in stock. Write for details.

LADLE BOTTOM TILE

Start your wits a dry bottom, with no joints. Easiest to install. Sizes 50 to 10,000 pound in stock. Large [illegible]

THE IRONTON DIVISION OF NORTH AMERICAN REFRACTORIES CO.
CLEVELAND 14, OHIO

For More Information Circle 698, Page 39

Give The UNITED Way

formerly was with Cleveland Pneumatic Industries, Cleveland. G. F. Ritter has been made service manager.

James R. Keogh has joined Mathews Conveyer Co., Ellwood City, Pa., as sales engineer in the

JAMES R. KEOGH
. . . joins Mathews Conveyer

Philadelphia territory. He has had long experience in the material handling field.

Alex J. Szabo has been named sales engineer, Cleveland district, Pangborn Corp., Hagerstown, Md.

ALEX J. SZABO
. . . Pangborn sales engr.

He joined Pangborn in 1956 and recently was supervisor, vibratory finishing division.

H. H. Herman has been named sales engineer in the Pittsburgh area, Rotor Tool Co., Cleveland. He formerly was associated with Thermal-Raye Corp., Pittsburgh.

In Milwaukee, at Grede Foundries, Liberty Division . . .

BERLITE lining in nodular iron ladle resists inoculation shock

5 factors favor NARCO-IRONTON BERLITE

Grede-Liberty foundrymen fill a 1500 lb ladle 200 times before the **BERLITE** lining is replaced. Exothermic boiling doesn't bother **BERLITE**, so who needs costlier special linings? Save on ladle upkeep with these **BERLITE** benefits:

- **LONGER SERVICE LIFE**
- **LOWER COST PER-TON-POURED**
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- **EASIEST CLEANING**
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Write to our Technical Service Department for Product and Service Data. Test **BERLITE** in your foundry. No obligation!

THE IRONTON DIVISION OF NORTH AMERICAN REFRACTORIES CO.
CLEVELAND 14, OHIO

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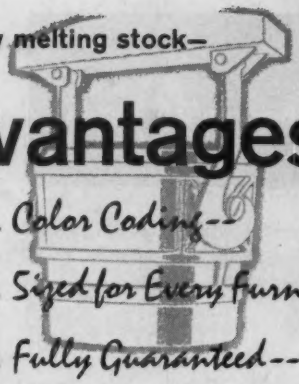
When it comes to Nickel-Alloy melting stock—
Only Security Gives These

9 Big Advantages

1. True Economy-
2. High Density-
3. Completely Clean-
4. Guaranteed Analysis-
5. Immediate Delivery-
6. Packaging to Order-
7. Color Coding--
8. Sized for Every Furnace-
9. Fully Guaranteed--



You can reduce melting time, improve casting quality, eliminate alloying up and down—with Security's PRE-ALLOYED FURNACE CHARGES. Most commercial alloys available. Find out how Security can save you time and money.

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HEAT AND CORROSION RESISTANT ALLOYS
HIGH TEMPERATURE ALLOYS
SUPER ALLOYS

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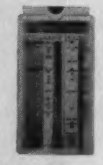
Send for New Free Pocket-Size Cast Alloy Slide Chart
A fingertip chart containing Engineering Properties plus Military, AISI, AMS, SAE, ACI and ASTM Specifications.



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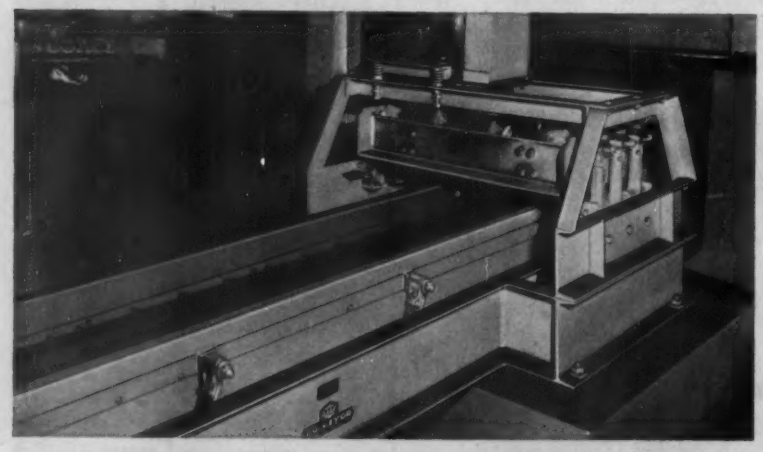
For More Information Circle 700, Page 39



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Conveyor Division
AJAX FLEXIBLE COUPLING CO. INC.
204 Portage Road Westfield, N. Y.
Representatives in Principal Cities

For More Information Circle 701, Page 39

OBITUARY

Elbert H. Neese Sr., 75, chairman of the board of directors, Beloit Iron Works, Beloit, Wis., died Sept. 17. He joined the company in 1916 and became president in 1932.

Oscar Edgar Ross, 64, founder and president, Portsmouth Casting Inc., Portsmouth, Ohio, died Sept. 5. He had been associated with the foundry industry for 43 years.

John A. Meyer, 81, died Sept. 11. Mr. Meyer had held supervisory and managerial positions in the Pittsburgh area with American Steel Foundries and Union Steel Works and National Alloy Div., Blaw-Knox Co. He was a past president of the Pittsburgh Foundrymen's Association.

William P. Brown, 85, former superintendent, Oklahoma Steel Castings Co., Tulsa, Okla., died Sept. 17.

George W. Zachariasen, 76, owner, National Pattern Works, Milwaukee, died Oct. 11. A patternmaker since 1904, he established his own firm in 1928.

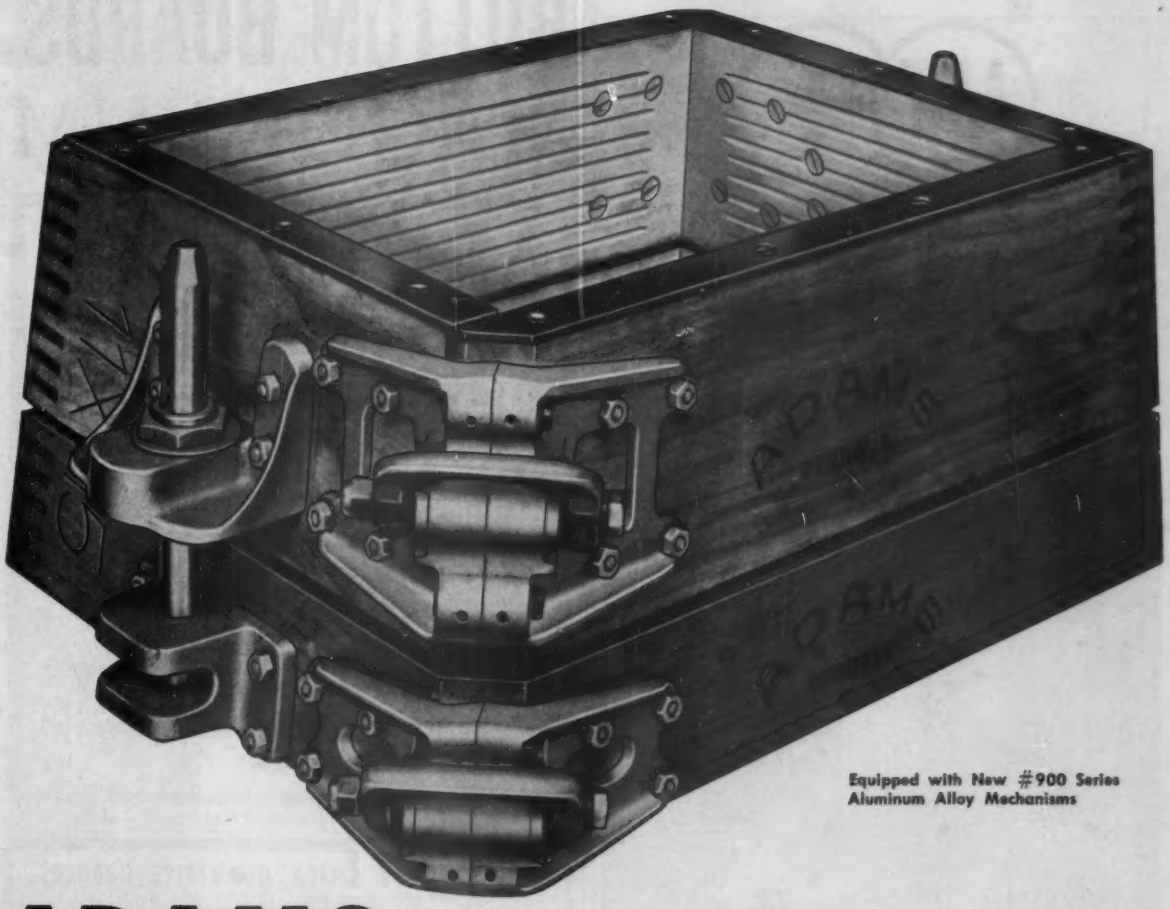
Mrs. Marie Sly, 87, former treasurer of the W. W. Sly Mfg. Co., Cleveland, died Oct. 7. Mrs. Sly was the widow of W. C. Sly, president, who with George K. Fanner, was killed in a payroll robbery in 1921.

Frank W. Schick, 71, partner in the former Frank Schick & Son, Philadelphia nonferrous foundry, died Sept. 29.

J. E. Thornton, 39, steel roll molding foreman, Ohio Steel Foundry Co., Lima, Ohio, died Sept. 17.

Edwin F. Neuman, manager of service, Automatic, division of Yale & Towne Mfg. Co., Chicago, died Oct. 11.

Hugh T. Lewis, 64, Chicago sales representative for Harbison-Walker Refractories Co., Pittsburgh, for more than 35 years, died Oct. 6 in Chicago.



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CHERRY EASY-OFF FLASKS are of proven design and construction.

CHERRY LUMBER is the finest available, carefully selected and thoroughly air dried.

SIDES AND ENDS finished 1½" on all standard size flasks. 1¼" and heavier on flasks of larger perimeters and greater depths.

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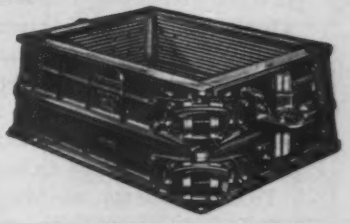

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Adams Jackets, Cast Iron or Aluminum

The ADAMS Company

ESTABLISHED 1853

MOLDING MACHINES and FLASK EQUIPMENT

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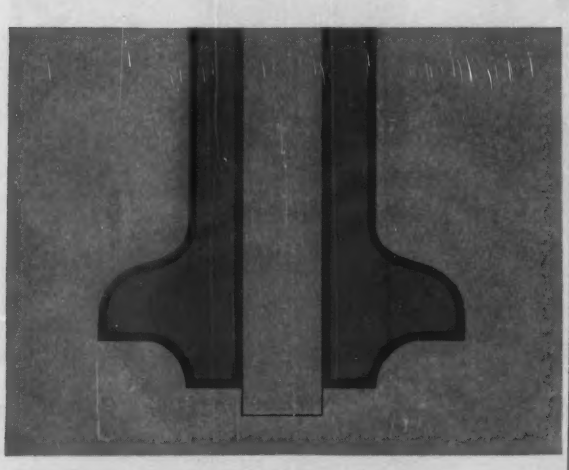
For More Information Circle 702, Page 39

M&T

OREFRACTION

Zircons give smoother surfaces



Orefraction Zircon provides a smoother finish and greater casting detail because of its finer grain and non-wetting characteristics.

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For More Information Circle 703, Page 39

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For More Information Circle 704, Page 39

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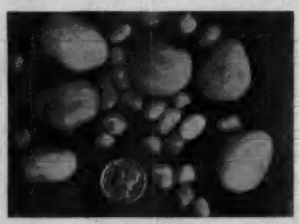
HIGH QUALITY • LOW ALUMINA



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For More Information Circle 705, Page 39

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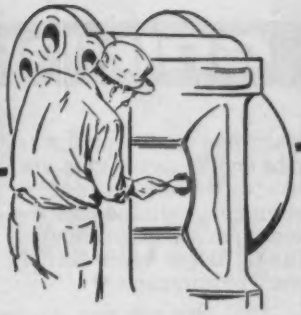

These features mean

BETTER LOOKING CASTINGS

TIGHT, LASTING REPAIRS

When correcting blow or sand holes, surface blemishes, or rough and porous areas in castings, you can depend on Smooth-On Foundry Cements, standard of the industry for more than 63 years. They are easy to apply, harden quickly, stay firmly in place.

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With 3 different shades to pick from, you know you can get a close match for your castings.

4AA—Light gray, fine texture
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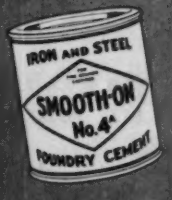

Why not try one or more of these Foundry Cements at our expense? We will be glad to send you a free sample of any of the cements described above if you will write us on your business letterhead. Write today, and see how Smooth-On can improve the appearance of your castings.

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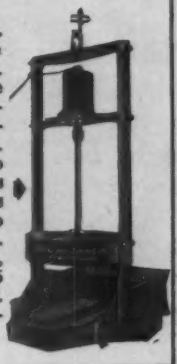
ACCURATE SCREEN-ABILITY

Combs Gyratory Riddles

"Greatest Name in Motion"

TYPE "CS". Complete price $435.00. 24" square sieve. A continuous operation sieve. Requires no dumping, as refuse is ejected off to one side. Height 4'10", weight 295 lbs, ½ H.P. enclosed motor.



TYPE "CR". Complete price $425.00. 24" dia. round sieve. Sifts, fluffs, mixes, aerates sand. Height 4'6", weight 250 lbs., ½ H.P. enclosed motor.

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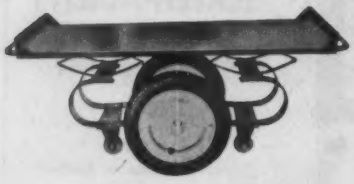
GENTLY WITH THIS RESILIENT CHASSIS TYPE B-1 CORE TRUCK.



Yes, this core truck with its resilient chassis and intermediate spring arrangement offers a better means of core transportation. Loading tray is 27" x 72". The resilient chassis is made of 3/8" x 3" spring steel properly heat treated. The guide wheels are 8" dia. and have rubber tires and ball bearings. The main running gear is equipped with 18 x 4.00 4-ply pneumatic tires mounted on disc wheels with Timken roller bearings, 1 3/8" shaft. Made by Arco Welding Service, Chicago.

AWS

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For More Information Circle 709, Page 39

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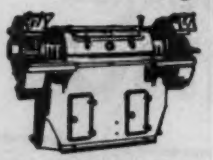
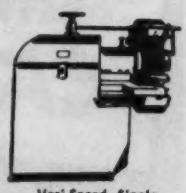


Belt drive & Gear Drive Grinder



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Portable Grinders 1/3 to 7½ hp

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For More Information Circle 711, Page 39

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New venting material for sand cores. Disintegrates completely if core is baked . . leaves no residue. Allows unrestricted use of cold-setting processes.

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For More Information Circle 712, Page 39

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496 PAGES 6x9 CLOTH BOUND PRICE $12. POST PAID

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For More Information Circle 714, Page 39

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GOULAC
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CORE WORK, SAND FACINGS, SPRAYS

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For More Information Circle 715, Page 39

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For More Information Circle 717, Page 39

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For More Information Circle 716, Page 39

For More Information Circle 719, Page 39

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For More Information Circle 720, Page 39

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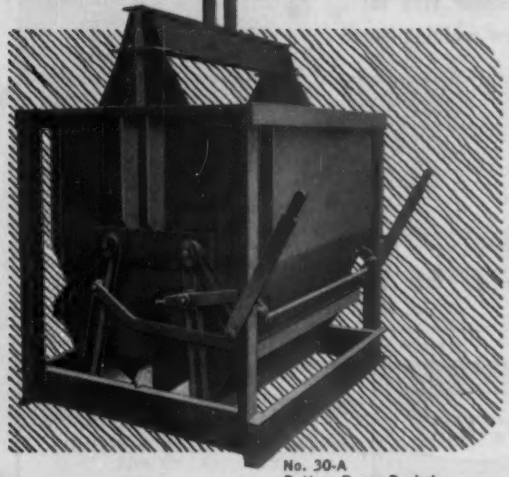

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Bottom Dump Bucket

Exclusive design makes this bottom dump bucket easy to operate . . . easy to open. Efficient for foundry use in handling all types of sand, moulding or core, dry or prepared. Can be used with coke, scrap iron and castings also. Sizes 7 to 200 cu. ft.

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For More Information Circle 722, Page 39

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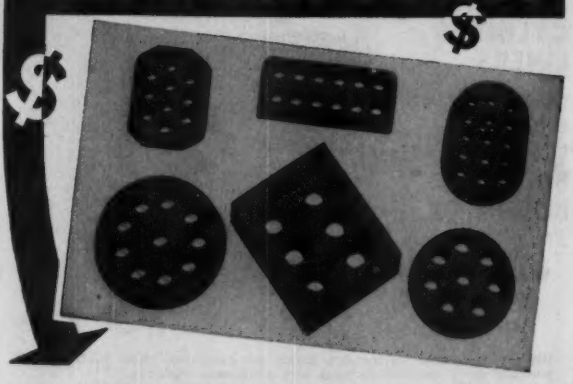

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For More Information Circle 724, Page 39

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A Better Way to prepare molding sand!

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For More Information Circle 725, Page 39

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automation equipment for production sand systems

Sand, Core, Shell and Mold Testing Equipment
CARBON and SULFUR DETERMINATORS

DIETERT DETROIT

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For More Information Circle 723, Page 39

For More Information Circle 726, Page 39

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Midwest gray iron jobbing foundry needs foreman experienced in medium and large castings from 500 pounds to 15 tons. Send complete resume. Address: Box 262, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MALLEABLE FOUNDRY & LIAISON MAN

Must be experienced in foundry operations, such as pattern layout work, foundry scrap control, and customer service-sales contacts. State age, education, experience, employment records and salary expected. Address: Box 277, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MALLEABLE IRON FOUNDRY SUPERINTENDENT

Experienced in all phases—to handle complete manufacturing process.

Send resume to

BOX 255, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

MELTING SUPERINTENDENT

Midwest foundry specializing in stainless steel and high alloy castings needs top caliber young, aggressive, working executive with a minimum of five years' experience in metal melting. Salary open to negotiation. Send resume. Address: STAINLESS FOUNDRY & ENGINEERING, INC., 5132 North 35th Street, Milwaukee 9, Wisconsin.

FOUNDRY FOREMAN

Foundry foreman experienced in all phases of brass and aluminum production capable of supervising thirty or more employees. Central Kansas location. Address: Box 257, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• HELP WANTED

MANUFACTURING MANAGER

One of the largest West Coast producers of investment and precision castings offers this challenging opportunity to a man with imagination and drive, plus the ability to get things done.

This position, reporting to the President, has complete responsibility and authority for all production activities.

Excellent salary and benefits, plus growth potential. Applicant must have engineering or metallurgical degree, plus a minimum of three to five years experience as superintendent, production manager, or manufacturing manager at a metalworking plant. Experience in investment casting desirable but not required.

Send resume in confidence to . . .

BOX 256, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

• POSITIONS WANTED

SUPERVISOR-METHODS AND TIME STANDARDS

Twelve years' varied I.E. foundry and manufacturing experience. Specializing work methods analysis and measurement, wage incentive installation and maintenance, other cost reduction areas. Have trained and supervised others in these activities and have designed and implemented related programs. Resume on request. DONALD JOYNT, 405 Greenbriar Drive, Lufkin, Texas.

PRACTICAL FOUNDRYMAN

If your scrap is high and your costs are up I can help you. Have always been able to get foundry out of trouble and make profit for company. Results guaranteed or no cost to you. Have 23 years of practical experience in all phases of foundry operations in gray iron, brass and bronze. Address: Box 280, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT OR MANAGER

Young foundryman thoroughly versed in all gray iron operations. Degree in Metallurgical Engineering. Interested in responsible position with opportunity. Address: Box 283, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

STAFF LEVEL

15 years of experience in gray iron, aluminum and brass foundries. Duties; methods, estimating, cost, incentives, production and purchasing. Address: Box 272, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT OR GENERAL FOREMAN

Permanent molding. Fourteen years' experience in all phases of permanent & semi-permanent molding. Now employed. Best references. Resume on request. Will relocate U.S.A. or other. Address: Box 264, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT—GENERAL FOREMAN

Practical and technical; presently employed in the East; over 30 years' experience; jobbing or production to 5 tons. Address: Box 275, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT

Gray iron foundryman. Twenty years' executive experience. Well versed in metallurgy, molding and cupola practice mix by analysis. Address: Box 276, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• POSITIONS WANTED

FOUNDRYMAN

Experienced in gray iron and nonferrous metals, mechanization, design, patternmaking, gating, risering, costs. Presently employed as pattern supervisor. Address: Box 267, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT OR GENERAL FOREMAN

Twenty-five years' supervisory experience in steel foundry jobbing and production. Includes carbon, alloy, and stainless steel—pressure and X-ray castings. Quality control, molding, melting, coremaking, cleaning, heat treating, sand mixtures, and gates and risers. Address: Box 278, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

DESIGNER OF PERMANENT MOLDS

Specialist in missile and aircraft castings of Aluminum and Magnesium. Location New York —New England area. Address Box 269, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

EXPERIENCED MOLDER

Desires position as foreman or supervisor. Thirty-two years in foundry. Understands rigging; green sand, dry sand, and loam molding; pit molding; coremaking; all size castings in Ni-Resist, Ni-Hard, 30% nickel brass, nickel aluminum, and Monel. Two years as coreroom foreman and five years as foundry foreman. Age 50. Address: Box 284, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• REPRESENTATIVES WANTED

INDIANA AND MICHIGAN TERRITORY

Leading manufacturer of foundry facings, supplies and refractories is interested in aggressive salesman. Must have foundry background and selling experience. Must be free to travel. Send complete resume. Address: Box 279, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• CONSULTANTS

CONSULTANT

Expert assistance in foundry operations gray iron, malleable iron and steel. Address: HERBERT F. MILLER, 589 Trade Winds Drive, Dunedin, Florida.

• OPPORTUNITY

LICENSE ARRANGEMENT WANTED BY BRITISH COMPANY FOR EUROPE

Well known British Corporation specializing in engineering, steel foundry work and forging has complete manufacturing and selling facilities covering the whole of Europe. This company invites U. S. firms to license them to manufacture and sell the following items:

Winches and Capstans, All Types of Crushers, Pulverizers, Centrifugal Pumps, Steel Valves, Gear Boxes, Rolling Mill Equipment, Oil Drilling Equipment.

Our U. S. Correspondents invite your replies.

BOX 273, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

• EMPLOYMENT SERVICE

FOUNDRY PERSONNEL SPECIALISTS

National Placement and Procurement of

GENERAL AND PLANT MANAGERS, PLANT SUPERINTENDENTS, FOREMEN—ALL DEPARTMENTS, METALLURGISTS, ENGINEERS, CONTROLLERS, ACCOUNTANTS, SALESMEN, SALES MANAGERS, PERSONNEL DIRECTORS, PURCHASING AGENTS

Confidential Inquiries Invited

From Employers and Qualified Applicants

For Fast Competent Assistance Contact

DRAKE PERSONNEL, INC. FINANCIAL 6-8700
JOHN COPE, DIRECTOR, 29 E. MADISON ST., CHICAGO 2, ILL.

• ACCOUNTS WANTED

ACCOUNTS WANTED

Established representative desires additional sand handling lines, especially conveyors, elevators and sand storage bins. Would also like to carry these lines into other industrial accounts. Territory is Indiana, northern Kentucky and southwestern Ohio. Address: Box 270, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOUNDRIES WANTED

FOUNDRY WANTED

GROUP OF FOUNDRY ENGINEERS AND INDEPENDENT MANUFACTURERS WANTS TO PURCHASE FOUNDRIES (FERROUS AND NONFERROUS) WITH OR WITHOUT PROPERTY. PLEASE SUBMIT COMPLETE DETAILS AS TO CAPACITY, TYPE OF PRODUCTION, FOUNDRY EQUIPMENT, FLASK INVENTORY.

PRINCIPALS ONLY
ALL REPLIES CONFIDENTIAL

BOX 265, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY—WANTED—EQUIPMENT

Foundry investment organization needs used equipment to activate and mechanize a large foundry. Complete foundry with or without property will be considered. Please be specific as to price and when inspection can be made. Principals only. All replies confidential.

BOX 268, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

• • • WANTED • • •

FOUNDRIES! DEAD OR ALIVE!

Consolidated foundry group seeking for expansion: steel, gray iron, malleable, ductile and nonferrous. Submit complete details.
Confidential—Principals only

BOX 258, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

• WANTED-TO-BUY

WANTED TO BUY

#7 Whiting Cupola. Also cupola block, charger and blower and cupola block for #5. Address: Box 282, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

WANTED TO BUY

Molding machines, International type JSK-7. R. E. Gilbert, GREAT LAKES FOUNDERS & MACHINE CORP., N. Washington Ave., Ludington, Michigan.

• FOUNDRY FOR SALE

FOUNDRY & MACHINE BUSINESS

Leading manufacturer of water works fittings selling complete foundry and machine shop. Owner is at retirement age and wishes to retire gradually over next few years. Founded 1930, consistent profitmaker. 8 acres, brick and steel buildings, main foundry 120 x 600. Over 200,000 square feet under roof, 2 rail sidings. Completely equipped. Receivables $50,000 more than payables, finished goods about $40,000. Equipment, trucks etc. worth over $500,000. Heavy backlog of orders; operating at capacity plus taking output of two other foundries. In distressed area, low labor costs, non-union. Will sell all stock in company for $300,000. 15% cash, balance over ten years. Can guarantee profit will pay for business. Jack Davis, AMERICAN CASTING SERVICE INC., Princeton, Indiana.

FOUNDRY FOR SALE

Mechanized gray iron foundry for sale, Rockford, Illinois. Capacity 100 tons per day. 70,000 square feet. One modern #7 cupola; one modern #6 cupola; one modern #5 cupola and one modern #2½ cupola. Address: Box 281, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOR SALE

FOR SALE

Reconditioned Wheelabrator & Pangborn blast machines, dust collectors and other foundry equipment. (Special) 1957—20/27 rubber belt Wheelabrator like new.

R. L. Markee
METAL FINISH & EQUIPMENT, INC.
4509 N. 124th ST. BUTLER, WISCONSIN
SPRING 4-0208

FOR SALE
All Equipment Excellent Condition!

1—Newaygo Reddy Sandy
3—Exhaust fans—36", wall type, 3 H.P.
2—Core ovens—Coleman, 4' x 3' x 6' high, controls on one.
2—Tabor 10" top squeeze & jolt.
6—Combs gyrating riddles, 20"
4—North American Blowers, 170 C.F.M. 8 oz. pressure, ¾ H.P.
1—Fisher Blower, 190 C.F.M. 16 oz. pressure, 1.5 H.P.
1—Pennsylvania after cooler, 5" x 12', 28 tube.

SCHAUER BRONZE & ALUMINUM FOUNDRY CO., INC.
7377 NORTHFIELD RD. BEDFORD, OHIO

SWING GRINDERS
FOR SALE
(Used—Excellent condition!)

FOX 10 hp. 3/60/220/440 volt takes up to 18" x 2" wheel $650.00
MARSCHKE 15 hp. 220-440 V. takes up to 24" wheel .....$750.00 each

C. GREENE EQUIPMENT CORP.
4014 W. 24th ST.
CHICAGO 23, ILLINOIS
LAFAYETTE 1-1322

• FOR SALE

FOR SALE

2 Simpson #3 UD Mullers
Simpson #3, style H Muller, enclosed gear
Simpson #2, style H Muller, enclosed gear
3 Simpson #2 Mullers, style C w/loaders & aerator & water meter
Simpson #2 UD Muller
Simpson #1 style C Muller, one wheel
3 B&P Mulbaros
3 B&P Model L screenerators
2 B&P #M screenerators
2 B&P #8 screenerators
2 Simplicity 2' x 3' portable sanditioners
Motive Jr. Sandslinger, 19" head—4" tip—2 speed—25/16 h.p.
B&P Stationary hydraslinger 22" head x 5" tip, complete with R & L arms, 2 speed, 40 diag. 25 h.p., with plate feeder
10 SPO 110 PJ jolt squeezers
10 Osborn 275 J jolt squeezers
4 SPO 113 PJ jolt squeezers
4 Osborn Model 276 PJ jolt squeezers
Tabor 40" x 58" hydraulic jolt rollover, 16" draw, very late
6 Int. PKL 14—jolt squeeze pin lift
SPO #2114G Jolt Squeeze Pin Lift—20" x 27" table—4" draw
6 Tabor 30" x 40" hydraulic jolt rollovers, 12" draw
Tannewitz 30" band saw—variable speed drive—new in 1960
Racine Band Saw—14" geared drive
Worthington 6 x 6 x 5 x 5, 25 H.p. air compressor direct connected, air cooled, 3—22440, 60 cycle.
Wheelabrator tumblast 36 x 42"
Wheelabrator tumblast 42 x 42"
Wheelabrator tumblast 48 x 72"
2 Wheelabrator 66" swing tables
Pangborn 6' rotoblast table, very late

PEK MACHINERY COMPANY
130 JACKSON STREET
BROOKLYN 11, NEW YORK
PHONE: EVERGREEN 8-3277 & 3278

FOR SALE

PANGBORN #9, TYPE LG-14
6—37" diameter tables
New in 1956....Excellent condition
Original Cost—$14,000.00
Machine plus many repair parts—$4,500.00

NOBLESVILLE CASTING COMPANY, INC.
NOBLESVILLE, INDIANA

FOR SALE

One AMERICAN Sand Cutting Machine #132, Model HP, size 56. Used but in good operating condition. Contact STRATTON & TERSTEGGE COMPANY, Anchor Division, Box 311, New Albany, Indiana.

FOR SALE

One model 2½F SIMPSON mix-muller, approximately 40 cu. ft. capacity, complete with dust hood and 60 h.p. motor. Excellent condition. Used 3 years. Address: Box 286, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

CLASSIFIED ADVERTISING RATES

(Effective Jan. 1, 1962)

POSITION WANTED—Minimum advertisement set solid.
30 words or less $5.00
Additional words .....20c each.

ALL OTHERS—Help Wanted, Employment Service, Wanted-To-Buy, Representatives Wanted, For Sale etc. minimum advertisement set solid,

30 words or less $11.00
Additional words .....40c each.

NOTE: If replies are to be sent to a box number in care of FOUNDRY, add 8 words to your advertisement for box number and address.

Any advertisement set in all capital letters, add 50% to the above rates.

Classified forms close the 10th of month preceding issue.

FOUNDRY

PENTON BUILDING CLEVELAND 13, OHIO

INCH RATES PER INSERTION

Single Column 2¼" Wide	One Time	Three Times	Six Times	Nine Times	Twelve Times
1 inch	$ 30.25	$ 28.75	$ 27.25	$ 26.50	$ 25.75
2 inches	59.00	56.00	53.00	51.00	49.00
3 inches	86.50	81.75	77.00	74.25	71.50
4 inches	112.00	105.50	99.00	95.50	92.00
5 inches	136.00	127.75	119.50	115.25	111.00
6 inches	158.50	148.50	138.50	133.75	129.00
7 inches	179.00	167.50	156.00	150.25	144.50
8 inches	198.00	185.00	172.00	165.50	159.00
9 inches	215.50	200.50	185.50	178.25	171.00
10 inches (1 col.)	231.00	214.50	198.00	189.75	181.50
15 inches (1/2 page)	334.25	309.50	284.75	272.25	259.75
20 inches (2/3 page)	429.00	396.00	363.00	346.50	330.00
30 inches (1 page)	620.00	570.00	520.00	495.00	470.00

Remittance should accompany advertisement when submitted —Cash Discount 2%, 10 days.

• FOR SALE

C. GREENE FOUNDRY CORP.

GOOD USED

FOUNDRY EQUIPMENT

SPO Jolt, Squeeze Pin Lift, models 2138C
SPO Model 9546 Jolt, squeeze, rollover draw
Simpson No. 2 enclosed gear muller
Simpson No. 3 Enclosed gear Muller
Simpson No. 1 Open gear Muller
Osborn squeezer 276J and PJ
(3) Pig Mold Conveyors
American Tumblast 27 x 36
American Tumblast 36 x 42 w/skip
J & J Model 918 Rollover
Herman 6,000 lb. Jolt Rollover
Sutter Core Rollover
International Model 30 x 8 Rollovers
International Model 24 x 10 Rollovers
International Jolt pin lifts all sizes
J & J Model 8128 Jolt pin Lifts Table 30 x 38
SPO Rollover pattern draw Model RD 6815 table 36 x 68 draw 15"
International plain jolt machines all sizes
Pulsator San Blo model 40 PL
Federal San-Blo Model CB 40
International core blowers all sizes
Champion core blower Model CB 10
International hand operated pin push ups
Robbins shakeout 4 x 6 and 6 x 10
Sly Tumbling barrels 3' x 4'
Pangborn Table cleaning machine Model LG6 with 6' table and 24" aux. tables complete with Dust Collector
American pneumatic rod straightener and shear
Ingersoll-Rand 100 hp Air Compressor
Air Compressors 25 hp.
Whiting coal pulverizer Model 30 complete
Whiting coal pulverizer Model 30A complete
Whiting No. 3½ Cupola
Dust Collectors many sizes
Fisher No. 1700 Melting Furnaces MNP
Fisher Aluminum Melting Furnaces 1000 lb cap.
Fisher Aluminum Melting Furnace 300 lb cap. motorized nose pour gas fired
Bondactor Model 1000L
Tessmer sprue cutters
Hough Payloaders Model HA ¼ yard
Tractomotive payloader ¾ yd. cap.
Air hoists 1000 lb. to 4000 lb.
Ladles all sizes
Steel flasks all sizes
Core ovens all sizes
Beardsley & Piper Tractor type slinger
Morgan 5 ton bridge crane 71' span with app. 220' runway
Laboratory equipment

Many More Items Available

WE SOLICIT YOUR INQUIRIES

WE BUY WE SELL WE TRADE

C. GREENE EQUIPMENT CORP.

4014 W. 24th St.

CHICAGO 23, ILLINOIS

LAFAYETTE 1-1322

FOUNDRY EQUIPMENT

12 Overhead Bridge Cranes, electrically operated; 5 to 25 ton; up to 50' span. Low as $750.
1—5 Ton Yard Crane 42' span; 220' runway.
1—7½ Ton Monorail Crane, 500' runway.
1—Coleman Tower Core Oven.
1—Bucket Elevator.
1—American Roto Clone.
1—Ingersoll-Rand Air Compressor with 75 h.p. motor.
1—D.C. Generator and Motor.
2—Whiting Cupolas #7 & #8.
Grinnel Dry Valves.

FOUNDRY BUILDINGS

60' x 300'—Steel Frame
50' x 270'—Steel Frame

HARRIS WRECKING COMPANY
1903 W. 3rd ST. CLEVELAND 13, OHIO
CH 1-1907

FOR SALE

36" x 42" AMERICAN WHEELABRATOR, Serial No. A63692; PANGBORN Table Blast with 6, 24" tables. Address: WELDON F. STUMP, 4835 Crestridge, Toledo 13, Ohio.

• FOR SALE

G-U-A-R-A-N-T-E-E-D
SAND BLAST EQUIPMENT
SELL BUY TRADE
TERMS AVAILABLE
Designers and Erectors of Specialized Blast Equipment

4' Wheelabrator Table Blast	$2250.00
8' Wheelabrator Table Blast	2750.00
6' Wheelabrator Table Room	6000.00
8' Wheelabrator Air Table	1700.00
48 x 48 Wheelabrator Tumblast	3000.00
42 x 48 Wheelabrator Tumblast	2750.00
36 x 42 Wheelabrator Tumblast	1500.00
27 x 36 Wheelabrator, new rubber belt	3000.00
4' Sly Air Table	600.00
Sly Air bbl #4	350.00
9 LG Pangborn Table w/6-36" Spinners	4000.00
6' LG Pangborn Table, Late	3000.00
6' Pangborn Swing Table, Like New	6000.00
Pangborn 53 EN-2 Hand Cabinet	325.00
Rumelin 8 x 8 Room	1000.00
Pressure Tanks, all types	$150.00 up
Vapor Blast Cabinets	400.00
Vapor Blast Automatic Table	2500.00

All types and sizes of Hand Cabinets, Dust Collectors, Pressure Tanks, Rooms, Horizontal or Vertical Tumbling Barrels and Additional Sand Blast Equipment too numerous to mention.
$100,000 worth of Wheelabrator and Pangborn Spare Parts Priced 25% to 50% Less List.
170 STEEL SHOT MIXED WITH G80 STEEL GRIT .....$125.00 ton

DIAMOND SAND BLAST EQUIPMENT CO.
5654 W. Jefferson Ave.
DETROIT 9, MICHIGAN
VI-3-6750

REPAIR AND REBUILDING SERVICE ON ALL PNEUMATIC TOOLS

We try to carry a complete line of "Hard Chrome Rebuilt Tools" at about half the cost of new tools. Before you discard your old tools, why not send them to us for our estimate on the cost of renewing them with our Hard Chrome Process?

CENTRAL PNEUMATIC SERVICE, INC.
512 LINDEN AVENUE
DAYTON 3, OHIO
PHONE: CL 2-2701

FOR SALE

1—Dietert Universal Sand Strength Machine
1—Dietert Perm Meter
1—Balance with weights
1—Sand Rammer

• • • $400.00 • • •

MEECH FOUNDRY, INCORPORATED
9066 MEECH AVENUE
CLEVELAND 5, OHIO

FOR SALE

4—Whiting side-blow converters
2—Stands
1—Blower, less motor
4—Ladles, crane type 46" dia x 45" deep
1—Milwaukee Foundry Equipment Co. briquetting machine, type 75-15"

BOX 274, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOR SALE

SIMPSON—#3 Muller, style H, enclosed gear. Good Buy! 3,000# batch.
BEARDSLEY & PIPER—#50 Speedmuller w/heater for coating core or shell molding sand.
COMBS Electric Riddles—20", (2)
HEWITT-ROBINS Shakeout—4' x 6'. Excellent!
WHITING #7 Model "B" Cupola—never used, complete with used G.E. Blower and used skip-hoist.

Other good equipment . . . give us a trial

McMAHON AND COMPANY, INC.
P. O. BOX 3014A AVONDALE STATION
BIRMINGHAM 12, ALABAMA
PHONE 592-4201

LIQUIDATION of former ALLIS-CHALMERS No. 2 FOUNDRY

ALL items moved to our Chicago warehouse. No more time left to sell on premises

JEFFREY APRON CONVEYORS
(1) 36" wide x 48" long
(2) 42" wide x 12'7"

BELT CONVEYORS
18" and 24" wide

BLAST CLEANING MACHINES
AM. continuous on 2 belts 25' long, 2 heads.
AM. 36 x 42 with skip.

CORE BLOWERS
INT. SB 11, universal head
CHAMPION CB15, univ. head

CORE OVENS
Dielectric 20 KW

CRANES
WHITING cupola charging, 3½ ton

CRANE BUCKETS
HAYWORTH electric, 1 yd. D.C.

DUST COLLECTORS
AM. dustube, many sizes
WHITING hydro clone
NEWCOMB-DETROIT

FURNACE
WHITING 25 ton crudle furnace complete with pulverizer and all necessary equipment

HOISTS
I-R air hoists ½, 1 and 2 ton

JOLT SQUEEZERS
MILWAUKEE 103, table 17x21
INT. LNS 12", table 17x20
OSBORN model 275PJ, table 16x21

JOLT SQUEEZE STRIPPERS
MILWAUKEE model 125, table 21x27
INT. PK18 table 24x36
SPO model 2136, table 22x30

LADLES
LIP pour, enclosed gear 29x29
Cylindrical, 27x35

MAGNETIC BELT CONVEYORS
JEFFREY 24" with Dings pulley

PAYLOADERS
MICHIGAN ¾ yd.

MOLD CONVEYORS
JEFFREY 352' long, cars 88, size 23x41, with cooling tunnel
JEFFREY 509' long, cars 101, size 33x44, with cooling tunnel

MULLERS
(3) SIMPSON No. 3, enclosed gear
SIMPSON #2, enclosed gear

SCALES
FAIRBANKS dial type, 10,500 cap. and 21,250 lb. cap.
Crane scale 10,500 cap.

SCREENS, VIBRATING
ALLIS CHALMERS 3 x 6
ALLIS CHALMERS 4 x 8

SAND CONDITIONER
BOYER Model DS 29

SWING GRINDERS
SAFETY 7½ hp.
FOX 10 hp.
MARSCHKE 15 hp.

TUMBLING BARRELS
WHITING 36" x 72"

Contact Mr. Earl Greene

WEISS STEEL CO., INC.
600 West Jackson Blvd.
Chicago 6, Ill. CE 6-1936

For More Information Circle 866, Page 39

NOW LIQUIDATING

A large farm machinery manufacturer

DUCTILE IRON FOUNDRY

in Chicago

Buildings being wrecked.
Everything must be sold.

Annealing furnaces—Bridge cranes—American Monorail—Bucket elevators — Roller conveyors — Core conveyors—Belt conveyors—Mold conveyors—Steel apron conveyors—Sandbelt conveyors—Magnetic belt-conveyors — Core blowers — Core ovens—5 ton OET cranes 50′ span —8 ton OET crane 50′ span—430′ cranerunway—Dust collectors—Fans melting furnaces—Handy Sandy—Hoists—Modern inoculation car—Ladles—Toledo hot metal scales—Modern FA9 pouring devices—Geared Ladles—45″ magnet — 1½ yard electric bucket—Molders hopper line—#126 Milwaukee molders —#124 Milwaukee molders—SPO 506 rollovers—Milwaukee & Harvester pin lifts — #2 & #3 Simpson mullers pug mills — 14′ turntables—B & P nite gangs—Jr. Nite gangs. Royers—Screenarators—Shakeouts—Sand screens—Counting scales—Tractor type sand slingers—Sand hoppers—Tumbling mills—Wheelabrators.

Write, wire or phone for complete list

ACME

EQUIPMENT CO., INC.

126 South Clinton St.

Chicago 6,

Illinois

Telephone: Andover 3-3430

For More Information Circle 867, Page 39

NOW LIQUIDATING

the Modern Well-Equipped Foundry

Coldwater Foundry *only of* Homer Foundry

290 S. Clay Street — Coldwater, Michigan

AIR COMPRESSORS

INGERSOLL RAND PHE—100 hp. New 1954; Ingersoll Rand ESI 12 x 11 75 hp 1951. (3) Older Compressors—Air Receivers.

CLEANING ROOM

PANGBORN 14LG5 60″ tables; PANGBORN barrel 14GK2; (3) TUMBLING MILLS up to 42″ x 72″

CORE ROOM

Lewis wire straightners and cutoff; 2A Climax straightner; International R, RJ and G rollovers and jolt rollovers; Core plates transite and metal; Sutter #520 core rollover, Champion CB5—CB10—CB15, Demmler #3E—#4; International SB13; HANSBERG H5 and H12 core blowers and shooters; Coleman 2-compartment 5′ x 10′—Despatch 10′ x 10′ and 8′ x 20′ CORE OVENS; core racks—core buggies; Milwaukee #70 core grinder.

HOT METAL DEPARTMENT

FA and F9 modern pouring devices, ladle heaters, pig molds, Whiting mixing ladle; #9 Whiting cupola; WHITING INCLINED SKIP HOIST CHARGER WITH BUCKET and SCALE; Syntron feeder; 4000# TOLEDO platform scale; SPENCER 100 hp. CUPOLA BLOWER.

MATERIAL HANDLING EQUIPMENT

(2) CLARK FORK LIFTS (1 New 1961); (4) YALE and TROJAN FRONT END LOADERS; WHITE TRACTOR and TRAILER; FOUNDRY DUMP TRUCK; UNIT CRANE on rubber; 39″ MAGNET, clamshell bucket; AIR HOISTS; (4) 2000# Keller (7) 4000# Ingersoll Rand (8) 2000# Ingersoll Rand; 16 bridge cranes w/runway; hand trucks, core trucks, hydraulic lift trucks, wheelbarrows.

MISCELLANEOUS

Rotap, speedy moisture teller; pipe threader; belt lacer; steam jenny; electric welders; grease equipment; 200 TONS STEEL FLASKS, 200 ALUMINUM POPOFF FLASKS.

MOLDING DEPARTMENT

(2) SPO 2194 jolt squeeze pin lifts; (2) 195 Milwaukee jolt squeeze pin lifts; (2) Milwaukee 244 jolt squeeze strippers; Milwaukee 165 jolt squeeze pin lift; International RES jolt squeeze rollover; (2) DAVENPORT 34AJS jolt pin lifts; (10) INTERNATIONAL Type G 24 x 10, 30″ x 8″ and 20 x 8; (4) #815 J & J's; (6) International portable jolt pin lifts.

MULLERS

SIMPSON 3F; SIMPSON #1½ Style C; CLEARFIELD 404.

PATTERNSHOP

Walker Turner radial saw; Crescent 16″ jointer; patternmakers lathe; patternmakers benches & vises; delta drill presses; 20″ Crescent band saw; MASTER 24″ DISC SANDER w/dust collector; spindle sander; Walker Turner radial drill, bench grinders, pattern lumber and supplies.

SAND SYSTEM

SIMPSON 3F MULLER with skip loader, aerator, dust hood; HARTLEY HYDRO-GUIDE timers, hopper, under muller conveyor; 24″ x 60′ JOY TROUGH BELT; 24″ x 180′ Distribution belt 9 hoppers; SIMPLICITY 36″ x 10′ FEEDER arranged for LOADER DUMPING; 24″ x 50′ Trough belt conveyor; Air operated skip hopper; SIMPLICITY 4′ x 10′ RING CRUSHER SCREEN MAGNETIC PULLEY—ROYER 30″ SAND CONDITIONER HANDY SANDY.

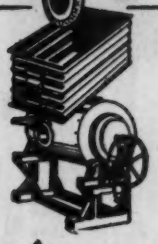
LIQUIDATING OFFICE **ACME EQUIPMENT CO., INC.**
290 S. CLAY ST., COLDWATER, MICH.
PHONE: BR. 9-9566

MAIN OFFICE **ACME EQUIPMENT CO., INC.**
126 S. CLINTON ST., CHICAGO 6, ILL.
PHONE: AN. 3-3430

For More Information Circle 868, Page 39

EUCLID FOUNDRY & MACHINE EQUIPMENT CO.

14919 SARANAC ROAD — CLEVELAND 10, OHIO



AIR HOISTS

5—300 lbs. I-R "Air-Block" Type LC3
5—500 lbs. I-R Air hoists Model A
3—1000 lbs. I-R Air hoists Model B
1—4000 lbs. I-R Air hoist Model D
2—5 ton I-R Air hoists Model E
1—8 ton Detroit Air hoist
6—Curtis Pendant Class G 1 to 3 ton
12—Hanna Pendant 100 lbs. to 1000 lbs.

HOISTS ELECTRIC

1—1 ton Cleveland Tramrail 220/3/60
1—1 ton Chisholm-Moore 220/3/60
1—2 ton Yale 230 V. D.C.

ROLLER CONVEYOR

1500 ft. 16", 18", 24", 30", 36"

FURNACES (oil & gas fired)

Hausfeld, Fisher, Monarch
#100 to #3000 Stationary & tilting
3—#1000 Fisher hydr. tilt, oil fired

ELECTRIC FURNACES

1—500# Lectromelt, 225 KVA, 2200 to 191 volts
1—1 ton Heroult, 800 KVA, 4300 to 300-225-178 volts

HEAT TREAT FURNACES

1—Lindberg Type 3854 EHV, 107 KW
1—Lindberg Type 6060 EH, 90 KW
1—Lindberg Car Type 72" x 84" x 96" 105 KW
1—Bellevue conveyor type, gas fired, 7'8" x 24'

CORE OVENS

1—Thermonic Dielectric Model M800A, 30 KW
1—Coleman Tower 40' high, gas fired
1—Porbeck 8 drawers, oil fired

SHAKEOUTS

1—Hewitt-Robins 12' x 10' 60,000 lbs. cap.
1—Hewitt-Robins 12' x 20' 68 tons cap.
1—3 x 10 Simplicity

SANDSLINGERS

1—B-P Stationary Riddle Type 19" head, 4" tip
1—B-P Stationary double belt 19" head, 4" tip

SAND MULLERS

Simpson
2—#1, Unit drive 4 cuft.
1—#1½, Unit drive 6 cuft.
2—#2 Type "E" 14 cuft.
2—#3 Unit drive 30 cuft.

Clearfield
1—#404, 4 cuft.
2—#610, 14 cuft.
1—#930, 30 cuft.

Beardsley-Piper
2—#40A, 9½ to 19 tons hr., air cooled
1—#50, 14½ to 29 tons per hr.

GRINDING EQUIPMENT

5 to 20 H.P. double end
30" to 53" Horizontal Gardner, Besley
7½ to 15 H.P. Swing Grinders, U. S., Mummert Dixon

SAND CONDITIONERS

B&P Screenarators Model S and M
2—Jeffrey Pugmills
1—American Type AA Sand cutter
1—Moulder's Friend

CORE BLOWERS

Champion, Demmler, International, Osborn, Sand Blo, Redford Taccone, 2 lbs. to 100 lbs. capacity

CUPOLA BLOWERS

Ingersoll-Rand, Roots, Spencer
15 to 75 H.P.

LADLES

3—4 to 6 tons bottom pour Whiting
3—3 ton T-pot
1—1½ ton T-pot
Lip pour ½ to 25 tons

BLAST CLEANING EQUIPMENT

1—15 x 20 Wheelabrator Tumblast
1—42 x 48 Wheelabrator Tumblast
2—26" Wheelabrator Continuous
2—72" Wheelabrator Swingout tables
1—48" Wheelabrator Swingout table
2—6' tables with aux. tables
1—6' Pangborn table, air induction
2—EN2 Pangborn Cabinets

DUST COLLECTORS

American, Sly, Rotoclone, Northern 600 to 4000 CFM

HANDY SANDYS and REDDY SANDY

single and double hopper type

HINES POPOFF ALUMINUM FLASKS AND JACKETS

large inventory of various sizes

MOLDING MACHINES

Automatic
2—Taccone's Model TDA-4, 24" x 24"
1—Shell core, C & S "Bio-Core", unused

JOLT ROLLOVER & DRAW

Davenport
2—Model SA28, 1500# cap. 12" draw, 30" x 40" table

Herman
1—10,000 lb. capacity 60" x 72" flask size
1—6000# cap., 40" x 72" table, 40" x 60" bumper
1—750# cap. floor type, 20" x 42" table

International
2—Type "G" 600# cap. 8" draw
2—Type "G" 1000# cap. 10" draw

Johnston & Jennings
2—Model 815, 1200# cap. 15" draw, 30" x 40" table
2—Model 918, 2000# cap. 18" draw, 44" x 54" table

Osborn
4—Model 601 Port. 10" draw, 24" x 30" flask
1—Model 602, 11" draw, 26" x 36" flask
2—Model 442 Port. 10" draw, 600 lbs.
2—Model 444 Port. 10" draw, 1000 lbs.
1—Model 243 Stationary 12" to 21" draw, 1500 lbs. cap.
1—Model 643 Stationary 17" to 21" draw, 2000 lbs. cap.
4—Model 405 Stationary 18" draw, 3500 lbs. cap.
8—Model 2047-4 Stationary 8" draw

Spo
1—Model 505, 400# cap., 6½" draw, 18" x 23" table
1—Model 506, 1200# cap., 12" draw, 28" x 30" table

Tabor
1—30" x 40" table, 12" draw, 1000# cap.
1—22" x 32" table, 10" draw, 600# cap.

JOLT, ROLLOVER, SQUEEZE, DRAW

Osborn
1—Model 3161 Rotalift
1—Model 431-4, draw 7", 600# cap.
1—Model 333, draw 9", 750# cap.

Spo
1—Model 917, draw 9", 750# cap.

JOLT, SQUEEZE, PIN LIFT

International
1—LJ8K, 12" squeeze cyl., 6" draw
3—PKL, 12" squeeze cyl., 8" draw

Osborn
6—710PJ, 10" Squeeze cyl., 6" draw
6—712PJ, 12" Squeeze cyl., 6" draw
4—716PJ, 16" Squeeze cyl., 7" draw
1—720U, 11" Squeeze cyl., 4" draw

Spo
2—2114G, 11" Squeeze cyl., 4" draw
2—2136, 13" Squeeze cyl., 6" draw

Milwaukee
2—125-3, 12" Squeeze cyl., 8" draw

Davenport
1—Model 34AJS, 2500# cap., 12" draw

Herman
1—20" x 36" table, 1500 lbs. cap.
2—36" x 42" table, 4000 lbs. cap.

Osborn
1—561, 40" x 50" table, 12" draw, 5000#
1—560, 32" x 45" table, 12" draw, 2500#
1—540, 29" x 38" table, 12" draw, 2000#
1—539, 25" x 33" table, 12" draw, 1200#
4—559, 25" x 30" table, 6" draw, 1200#
1—558, 20" x 24" table, 4" draw, 550# cap.

Spo
2—3070, 26" x 35" table, 10" draw
1—307, 23" x 30" table, 8" draw, 1500#
1—3058, 23" x 27" table, 8" draw

Nichols
2—Model 24-54D, Flask size 24" x 27" 24" Squeeze Piston—1600# Jolt Cap.

PLAIN JOLT

Davenport
2—Model AJ-10, 30" x 45" table, 3000#

Osborn
1—Model 103, 54" x 66" table, 6400# cap.

J & J
1—42" x 50" table 5000# cap.

PUSH-OFF

Champion
4—AL 2424, 8" lift, 2000# cap.
1—AL 3036, 6" lift, 3500# cap.

International
1—LP-6, 8" lift, 1000# cap.

CORE ROLLOVER MOLDING MACHINES

International, Osborn, Tabor

JOLT SQUEEZE MOLDING MACHINES

Stationary and Portable, 10", 12", 13", 16" squeeze cyl.

ASK FOR OUR COMPLETE LISTING—CALL GLENVILLE 1-1222

PARTIAL LISTING OF EQUIPMENT NOW AVAILABLE — INQUIRIES INVITED

SAND MULLERS

CLEARFIELD

MODEL	PAN. DIA.	CAPACITY
404	4'	400#
610	6'	1500#
930	9'	3000#

BEARDSLEY & PIPER

MODEL	CAPACITY	AIR COOLED
30	4 cu. ft.	Yes
40	6 cu. ft.	Yes
60	12 cu. ft.	Yes
70	15 cu. ft.	Yes
80	20 cu. ft.	Yes

ALL CAN BE EQUIPPED WITH SKIP HOIST MULTRAMATIC CONTROLS, ETC.

SIMPSON

MODEL	PAN. DIA.	CAPACITY	DRIVE
1-C	4'	400#	Open
1-H	4'	500#	UD
1½	4'6"	700#	UD
2	6'	1500#	Encld.
2-B	6'	1500#	Open
3	8'	3000#	UD
3	8'	3000#	Encld.
3½	9'3"	5000#	UD

ALL CAN BE EQUIPPED WITH NATL. ENG. SKIP HOIST LOADERS.

LANCASTER

MODEL	PAN. DIA.	CAPACITY
EA4	59"	9 cu. ft.
EBG-4	59"	9 cu. ft.

OSCILLATING CONVEYORS

AJAX ENGINEERING (Lo-Veyor)

MODEL	SIZE	CAPACITY in T P H
LC 24-6-7	24" W x 7' L	70
LC 36-6-9DA	36" W x 9' L	100
LC 36-6-14 DA	36" W x 14' L	100

SIMPLICITY ENGINEERING

OA-10-JA	24" W x 13' L	150
OA-10-JA	24" W x 11' L	150
OA-10-JA-2	30" W x 7' L	150
OA-10-JA	30" W x 13' L	100
OA-10-A	36" W x 10' L	200
OA-10-A	36" W x 16' L	200
OA-10-A	36" W x 25' L	000

SANDSLINGERS

B&P Stationary, Model "DB," 5' jib arm, 4' ram, 19" head, 5" cup, 2-speed, 20/13 HP. Raising & lowering arms or fixed.
B&P Stationary, Model "DB," 8' jib arm, 4' ram, 19" head, 4" tip, 20/16 HP. Raising & lowering arms or fixed.
B&P "Motive Jr.," 11' jib arm, 4' ram, 16" head, 4" cup, R & L arms, 2-speed, 20/13 HP.
B&P "Motive," 15' jib arm, 9' ram, 2-speed, 25/16 HP. With Raising & Lowering.
B&P Speedslinger, Stat. 50 h.p. 22" head.

INDUCTION MELTING FURNACES

2—AJAX 20 KW convertor type, 3000 cycle, w/two 20# furnaces
5—AJAX 150 KW Melting Furnaces, 440 V, 60 cy. 1000 to 1200# brass
6—AJAX Model C8-1 35 KW Melting & Holding furnaces. 800# hold, 175# melt.
4—TOCCO 15 KW, 10,000 cy., 15# fur. Will melt 12# steel in 19 min.
1—10# HORACE DREVER, Indirect Arc Melting Furnace, 3000°F.

CUPOLA BLOWERS

INGERSOLL RAND

MODEL	C F M	PRESSURE	HP
FS-337	3000	20 oz.	25
FS-345	4500	16 oz.	30
FS-355	6000	16 oz.	40
FS-387	10,200	20 oz.	75
FS-377	10,500	20 oz.	85
FS-565	14,100	40 oz.	200

ROOTS CONNERSVILLE

RCR	1040	20 oz.	10
RCB	9075	32 oz.	100

STILL LIQUIDATING! BUY FROM LOCATION PRIOR TO REMOVAL—ROCK ISLAND, ILLINOIS

I-R Cupola Blower, type FS-554, 8700 CFM, 2# pressure, 100 HP, New 1951.
FOUNDRY EQUIPMENT CO. "COLEMAN" Core Oven, 3-compartment. I.D. 77" W x 12' L x 78" H. Overall—8' W x 13' L x 7'4" H. Each comp. has individual gas burner & recirculating chamber.
DESPATCH Continuous Type Core Oven, style "S", 46' L x 20' W x 10' H, with 250' of Jarvis B. Webb #678 chain conveyor. With 50 carriers—4' x 5' x 6', each carrier having 8 shelves.
INTERNATIONAL Core Blower, model SB-15-H. Complete with sand reservoir. Ser. #60696-1.
INTERNATIONAL "REDP" Core Rollover, 24" x 36" x 12" draw.
SIMPSON #3 Unit Drive Sand Muller, with #3 skip hoist loader, dust hood, 50 HP motor, etc. Ser. #55112.
BEARDSLEY & PIPER #80 Speedmullor, batch 24 cu. ft., 5'6" dia. of pan, with batch hopper, water meter, dust hood, cooling fan, 125 HP motor.
AMERICAN AIR FILTER #27 Roto-Clone, arrangement "C", Type "W", with sludge ejector.
PANGBORN Multi-table Tableblast, model 9LG. 9' dia. main table. With six (6) 36" dia. auxiliary tables.
NEWAYGO 5-ton Plate Feeder, 5' dia.
2—OSBORN #442 Jolt Rollover Pattern Draw Machines.
2—INTERNATIONAL "PK-18" Jolt Squeeze Pin Lift Machines, size 18" x 8" draw—18" sq. cyl.
10—INTERNATIONAL Pin Strips, size 30 x 54 x 8 Y—portable.
8—MILWAUKEE Jolt Squeezers, model #104-5, table—17" x 21".
MORGAN 10-ton Crane, cab operated, 65' span, 240' runway, 16' high, lifting height 25', voltage—220V-DC.
SPO model 9546 Jolt Squeeze Rollover Draw, semi-automatic. Jolt—1000#, squeeze 14,500#, table—26" x 32".
2—MODERN #8 Cupolas w/swivel type skip hoist charger, scales, bins, etc. New 1952. Exceptionally clean.
ALSO—Air Hoists, Bridge Cranes, Tramrail, Tumbling Barrels, Core Racks, Ladles, Roller Conveyor, etc.

DIELECTRIC CORE OVEN

1—COLEMAN Model CD-75 Dielectric Core Oven 10' Wide 40' Long x 7' High—Mesh Belt Conveyor Type. Belt width 5'—Work area 64" Width x 19" High opening. Power required 165 KVA, 3 Phase, 60 Cycle, 460 Volts. Unit new in 1957

WHEELABRATOR TUMBLAST

size	capacity (cu. ft.)	
27 x 36	5	w/skip hoist
36 x 42	11½	w/skip hoist
42 x 42	17½	w/skip hoist
48 x 48	20	w/skip hoist
48 x 72	30	w/skip hoist

TABLASTS

AMERICAN #1—4' Plain Table
PANGBORN 6LG-14—6' dia. w/6-24" aux. tables
PANGBORN 9LG-14—9' dia. w/6-36" aux. tables
PANGBORN 6LK—6' dia.—72" swing-out table
PANGBORN 6LF—6' dia.—Plain Table

ELECTRIC DUPLEXING FURNACE

1—WHITING 10 ton Hydro-Arc Furnace for Duplexing Malleable Iron from cupola, 10' dia. shell, motorized tilt 9" dia. electrodes, cap. 18 to 23 ton per hour, w/Allis-Chalmers 2000 KVA transformer, 12,000 volt-motorized tap charger. New 1953.

JOLT ROLLOVER PATTERN DRAW

DAVENPORT

MODEL	TABLE SIZE	DRAW	CAP.
24 SA	24" x 38"	12"	1000#
28 SA	28" x 40"	12"	1500#
34 A	34" x 58"	15"	2500#
48 A	48" x 82"	24"	6000#

INTERNATIONAL

AN	40" x open	20"	4500#

JOHNSTON & JENNINGS

612	24" x 30"	12"	600#
815	30" x 40"	15"	1200#
918	44" x 54"	20"	2000#
920	44" x 54"	20"	2000#
1020-RC	50" x 60"	20"	3000#

OSBORN

242-W	29" x 42"	12" to 19"	1500#
244	35" x 52"	16" to 25"	3000#
405	57" x 64"	26"	3000#
442	21" x 31"	10"	600#
601	24" x 30"	10"	900#
602	30" x 36"	12"	1200#
643	35" x 50"	20"	2000#

SPO

505	18" x 23"	6¼"	400#
506	24" x 25"	10"	600#

TABOR

22"	22" x 32"	10"	600#
22"	22" x 42"	10"	600#
30"	30" x 40"	12"	1000#

JOLT PIN LIFT MACHINES

DAVENPORT

MODEL	TABLE SIZE	DRAW	CAP.
34 A-JB	36" x 46"	12"	2500#

INTERNATIONAL

JDP 1200x8	24" x 26"	8"	1200#
JDP 3000x10	48" x 48"	10"	3000#
JL	32" x 52"	12"	2000#

JOHNSTON & JENNINGS

68-SP	25" x 30"	8"	600#

MILWAUKEE

1030	28" x 34"	8"	1000#
2036	32" x 38"	10"	2000#
2542	38" x 42"	12"	3000#

OSBORN

540	32" x 52"	12"	2000#
560	32" x 45"	12"	2500#

SPO

307	26" x 30"	10"	1200#

JOLT SQUEEZERS

MILWAUKEE

MODEL	TABLE SIZE	SQ. CYL.
104	15" x 15"	10"
123	17" x 26"	12"
141	20½" x 30"	14"
181	24" x 36"	18"

OSBORN

275-J	16" x 20"	10"
276-J	17" x 26"	13"

SPO

110-J	17" x 20"	10"
113-P	18½" x 26"	13"

JOLT SQUEEZE PIN LIFT MACHINES

MODEL	TABLE SIZE	DRAW	DIA.	CAP.
PKL-12	18" x 24"	5½"	12"	600#
PKL-14	20" x 28"	5½"	14"	1000#
PK-16	20" x 30"	8"	16"	1700#

MILWAUKEE

125	21" x 27"	8"	12"	1200#
145	24" x 30"	8"	14"	1700#
195	28" x 39"	10"	19"	3000#
196	16¾" x 39"	10"	19"	3000#
214	20" x 32"	10"	21"	2500#
244	22" x 32"	12"	24"	3000#
245	35¼" x 42"	12"	24"	5900#
246	23¼" x 42"	12"	24"	5900#

OSBORN

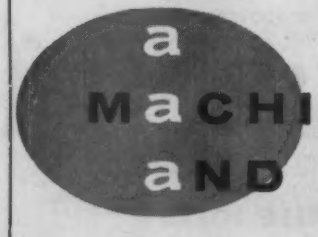
710-PJ	16" x 25"	6"	10"	500#
712-PJ	18" x 28"	6"	12"	750#
714-PJ	20" x 31"	7"	14"	1000#
716-PJ	22" x 34"	7"	16"	1250#

SPO

2136	21" x 30"	6"	13"	800#
2146	23" x 31"	6"	14"	1000#
2148	23" x 31"	8"	14"	1000#

JOLT SQUEEZE ROLLOVER DRAW

MODEL	TABLE SIZE	DRAW	CYL.	CAP.
MILWAUKEE				
167	32" x 33"	12"	16"	1000#
217	35" x 41"	12"	21"	1200#
OSBORN				
332	26" x 36"	9"	16"	750#
333	32" x 45"	11"	19"	1400#
SPO				
413-C	24" x 25"	10"	13"	600#
917-A	26" x 36"	9"	17"	750#
9546	28" x 32"	12"	16"	1000#



"Built on a Foundation of Mutual Trust"

EQUIPMENT COMPANY

10900 CEDAR ROAD • CLEVELAND 6, OHIO • SW 1-3900

THE ACME bargain page

BLOWERS
I.-R. 12900 cfm, 100 h.p. 220-440 V. 20 oz.
GE 10500 cfm., 20 oz., 85 h.p., 220 V.
GE 7500 cfm., 20 oz., 59.6 h.p., 220-440 V.
SPENCER 7350 cfm., 16 oz., 50 h.p.
GE Centrifugal 6200 cfm., 24 oz., 58 h.p.
6000 cfm. INGERSOLL-RAND 32 oz.
SPENCER 3500 cfm., 20 oz., 40 h.p.
SPENCER 2250 cfm., 16 oz., 15 h.p., 220
SPENCER 1350 cfm., 32 oz.
NORTH AMERICAN 1050 cfm., 16 oz.
NORTH AMERICAN 850 cfm.
500 cfm NORTH AMERICAN 12 oz.
McKee 200 cfm
2—SPENCER Turbo 50 hp 4800 cfm 24 oz.
2—SPENCER Turbo 50 hp 3600 cfm 24 oz.

CLEANING EQUIPMENT
48" x 48" AMERICAN w/skip
6' Table PANGBORN
AMERICAN #2 Tablast 8-28" tables, late
PANGBORN GD1-Airblast Barrel
88" PANGBORN double swingout table
SLY #4 Blast Mills

CONVEYORS
17' BARBER GREEN Bucket Conveyor
1500'—458 Chain w/drive, will sell all or part
24" x 13'-9" Magnet Belt

CONVEYORS, OSCILLATING
24" x 40' Ajax
SIMPLICITY 18" x 24'
SYNTRON 24" x 6'
AJAX 12" x 20'6"
36" x 11' Ajax
8" x 13' Ajax
3' x 10' SIMPLICITY OA-10A

CORE BLOWERS
CB15 55# cores, Universal blow plate
CB5-4# cores
DEMMLER #50
1—DEMMLER #55 w/ vibratory hopper
2—DEMMLER #55 w/plain hopper
DEMMLER 2EO
DEMMLER 2K
INTERNATIONAL SB 15H, up to 150# cores. Hydraulic clamp and draw
INTERNATIONAL SB 13, up to 60# cores
6—OSBORN 193 up to 50# cores
REDFORD Bench #2 & #4

CORE GRINDERS
1—MILWAUKEE 70-9

CORE OVENS
THERMONIC INDUCTION MODEL 1800A
2—Despatch ET. Draw Type

CORE ROLLOVERS
2—INTERNATIONAL GR hand ram power rollover 22" x 24" x 10" draw
INTERNATIONAL REDP Rollover 12" draw
SUTTER #500

CRANES
2—WHITING 10 Ton cap. 107'3½" span, OETC Outdoor type
1—WHITING 3 Ton OETC Cupola Charge Crane, 20' span

CUPOLA GUNS
1—Bondactor #1250 and 1000

CUTOFF SAWS
UNUSED DEWALT CUTOFF SAWS for ferrous or nonferrous metals cutoff or as sprue cutters. Flush blade adapter takes up to 20" abrasive blade or saw. Power Hoist to arm. Chain & Sprocket cross feed for working on heavy cast iron 48" x 60" "T" slot table or off table cutting or large work. Motor swivels horizontal to vertical in yoke.

DUST COLLECTORS
ROTOCLONE 8D 2000 cfm 5 hp
SLY #11—500 cfm
ROTOCLONE 8B 2000 cfm w/after cleaner

ELECTRIC MELTING FURNACES
1—DETROIT "LFA" 350# shell 13200 V.
1—DETROIT "LFC" 700# and 350# Tapered Shell 2300 V.

FURNACES
400# Fisher Motorized Tilt, Gas Fired
600# Fisher Stationary
600# Campbell Hausfeld Brass

GRINDERS, MISC.
U.S. #70 Comb. 20" disc & 20"x3"x1½" wh
53" Hanchett Horizontal Disc
GARDNER 36" Vert Disc
BRADFORD Metalmaster 18" Disc
STANDARD 24" disc & snag

GRINDERS, SNAG
US #64 D.E. 20" x 3" x 10"
#5 Fox Sgl. Wh. 24" snag.
2—KLING type RT H.D. 24" x 3" x 12" D.E.
KLING H.D. 20" x 2" x 7" D.E.
5—#6 FOX Single Wheel 24" Snag
STANDARD 20" x 3" 7½ h.p.
STANDARD 30 h.p. Type 50—30" x 5"

GRINDERS, SWING FRAME
FOX 24" x 3" x 12", 15 h.p.
MARSCHKE 24" x 3" x12" 20 h.p., 220 V.
U. S. 24" x 3" x12" 15 h.p., 220-440 V.
2—MARSCHKE 3 h.p., 12" wheel

HEAT TREATING FURNACES
G. E. Elevator Type 1950° Atmosphere Generator 65" x 16' car. Electric. Late
G. E. Elevator type 2150°—96" x 144" car atmosphere generator. Electric. Late
3—ABBOTT 24" H x 22" Deep x 30" Wide, Gas Fired
HOLDEN #202 1850° Bright Hardening Annealing
HOSKINS 40 KW—1850°
25 KW Westinghouse 2000°

HOISTS
6000# Cleveland w/monotractor travel
15—INGERSOLL-RAND 500# to 6000#
4—2000# R & M
1—500# Ingersoll-Rand LC-4

INDUCTION MELTING EQUIPMENT
30 KW Lepel Spark Gap

LADLES and POURING DEVICES
WHITING 16000# Crane
4000# Industrial Holding
WHITING 28 x 28—2300# Iron
MODERN 1000#—Geared Covered Crane
9—MODERN FA9 Pouring Devices 2000# cap.
6000# WHITING enclosed gear

MOLD BLOWER
TACCONE TD4 24" x 32" flask

MOLD CONVEYOR
366'—51—44" x 66" cars

MOLDING MACHINES
JOLT SQUEEZE PIN LIFT
6—MILWAUKEE 2646 Jolt Squeeze Strip rolloff—rolling molding machines 10" jolt cylinder; 1800# capacity, 26" Squeeze cylinder; 13" draw. Flask size 25½" to 29" wide, 52" long. FACTORY REBUILT.
MILWAUKEE No. 145-2, 27" x 30" table
8—OSBORNE 712 PJ 18" x 28" table
1—CHAMPION JSL10P 18" x 21" table 6" draw

JOLT SQUEEZERS
MILWAUKEE 181-7, 24" x 36" table
MILWAUKEE #162—1, 900 lbs. cap.
2—113 PJ SPO
OSBORN 275PJ
25—124 MILWAUKEE Portable Jolt Sq.
6—104 MILWAUKEE Portable Jolt Sq.
8—MILWAUKEE 103-5 17" x 26" table

JOLT ROLLOVER DRAWS
2—918 J & J 2000# cap. 20" draw
643 OSBORN 2000# cap. 20" draw
40" TABOR 2000# cap. 15" draw
30" TABOR 1000# cap. 12" draw
SPO 506
34A DAVENPORT
DAVENPORT 24SA 900# 24" x 28" table
HERMAN 3000#
2—750# HERMAN 20" x 30" table
INTERNATIONAL RJ 20" x 12"

JOLT SQUEEZE ROLLOVER DRAW
OSBORN 331-332-333
SPO 413D
INTERNATIONAL RES

PLAIN JOLT
36" x 60" Herman

JOLT PIN LIFTS
1536 MILWAUKEE 1500# cap. 12" draw
1030 MILWAUKEE

MULLERS and MIXERS
1½ SIMPSON U.D. Model 700#
1—#3 UD Simpson
3—#2 Simpson UD
#40 B & P w/skip and water meter
#60 B & P Rebuilt mtr. & starter
CLEARFIELD #494
1—#2 SIMPSON OG
CLEARFIELD #610

ROLLOVERS
HERMAN 46" x 112" charge conveyor rollover 56" draw, late

SAND CONDITIONERS
AMERICAN 51"
ROYER NDC—ND2
SCREENARATORS L

SAND SLINGERS & EQUIPMENT
3—19"—2 speed Stationary
1—14' Turntables
3—7' Plate Feeders, 35 & 45 Tons
B & P 44-44 Speed Draw 12" draw

SAND SYSTEM EQUIPMENT
28' Newaygo Bucket Elevator 12" x 7"
3—7' B&P Plate Feeders, 35 & 45 Tons
2—18" x 52' Magnetic Belt
4' x 8' SIMPLICITY ring crusher screen

SAWS, BAND
30" LAIDLAW, Metal Cutting hydraulic

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FAIRBANKS charge scale 11250# cap.

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6' x 10' SIMPLICITY, Som—11, Spring Mounted

4 x 8 LINK-BELT
2' x 8' Double Deck
4 x 6 LINK-BELT
6 x 10 HEWITT-ROBINS

SHELL EQUIPMENT
SHELL PROCESS 20" x 30" pattern size w/shell blender and bonding press

SPRUE CUTTERS
1—MILWAUKEE #85 TON
OBERMAYER 2 H.P.

STRAIGHTENING PRESS HYDRAULIC
225 ton Southwark
150 ton Farquhar "C" Frame
60 ton Lempco 4 post
25 ton Fox
25 ton Dennison

TESTING EQUIPMENT
ARLIN Automatic Rockwell, continuous
COLEMAN 55 Spectrophotometer
GOGAN Model 1414-2V

TUMBLING BARRELS
ROTO-FINISH Model DW 45-36
SLY, 24" x 48"; 3 H.P.
SLY, 30" x 60" Duplex

WOODWORKING—PATTERNSHOP
OLIVER #290 Dbl Arbor, Tilt-Arbor Saw
1—OLIVER 182D, 15" Disc Sander
CRESCENT 24" planer
6", 8", 12", 20" and 30" Jointers
24" x 36" Band Saws

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PATTERN MILLER

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B & P Tractor type, 6' jib, 4' ram arm, 19" head
B & P Stationary Type 6' Jib, 4' Ram Arm, 19" head, 25 HP

SHELL SAND MULLERS
2—B & P No. 3½ Mulbarrows with cycle controls and timers.
2—B & P No. 30 Speedmullers with skip hoists arranged for shell sand.

JOLT SQUEEZERS
Osborn 275J
Osborn 276, 13" Portable and Stationary
International LJS 10"—12"
International PJS 16"
Tabor Top Squeeze 10"
SPO 110J
Champion 10"
Milwaukee 104-5—10"—12"
SPO 213G
SPO 113J, Jolt Squeeze Pin Lift
Milwaukee 165, 24 x 30 table, 8" draw, 16" cylinder

JOLT SQUEEZE PIN LIFT
Milwaukee 126 Portable 21 x 27 Table 8" Draw
Milwaukee 145 24 x 30 Table 8" Draw
Milwaukee 195, 28 x 39 table, 10" Draw
Osborn 712 18 x 28 Table 6" Draw

2—Milwaukee 195, 28 x 39 table, 10" draw

JOLT ROLLOVER DRAW
International "G" 30 x 12
International "F" 45 x 72 x 16" Draw
J&J 612, 25 x 30 x 8" Draw
J&J 815, 30 x 40 x 15" Draw
J&J 918, 44 x 54 table, 18" Draw
J&J 1020B, 50 x 60 table, 20" Draw
SPO 506, 24 x 25 table, 10" Draw
SPO 508, 28 x 30 x 9" Draw
Tabor 30 x 50 x 12" Draw Shockless

JOLT PIN LIFT
Davenport 34A, 36 x 46 x 12" Draw
J&J 1216S, 36 x 54 x 16" Draw
J&J 688, 24 x 30 x 6" Draw
Milwaukee 1536, 32 x 38 x 10" Draw
Osborn 558 20 x 24 x 5" Draw
SPO 307G

JOLT SQUEEZE ROLLOVER DRAW

SPO 9546, 30 x 40 Flask 11" Draw
SPO 920, 32 x 44 Flask 11" Draw
Osborn 332, 26 x 36 Flask 9" Draw

PLAIN JOLTERS
J&J 72 x 72
Tabor 48" x 60"

SAND MULLERS

SHELL SAND MULLERS
B & P No. 3½ Mulbarrows with cycle controls and timers.
B & P No. 30 Speedmullers with skip hoists arranged for shell sand.

Simpson #1, Style "H"
Simpson #2 w/skip (open gear)
Simpson #2 UD w/aerator and skip hoist
Simpson #3, Style C, enclosed gear with skip hoist
Simpson #3 UD auto-cycle, dust hood, etc.
B & P No. 40 with cooling, water meter, dust hood and cycle timers
B&P #3½ Mulbaro
B&P #30 with skip hoist
B&P #60, w or w/o Multromatic
Clearfield 610
B&P 50 with skip hoist, cooling and water meter
Simpson #3, Style C, enclosed gear with skip hoist.

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B&P Screenerators, M. L.
B&P Junior Night Gang
Royer NDP, NC2, JR, and NC4
American Sand Cutter, various sizes
Newaygo Handy Sandy HS7GT

SHAKEOUTS
Simplicity 6 x 8
Allis-Chalmers 8 x 10
Simplicity 4 x 6
Simplicity 4 x 8

CORE BLOWERS
Redford No. 1 and No. 2
Champion, CB15
Chicopee Core Chief shell core blowers
Demmler No. 55, No. 1, No. 2, 2E, 3
Hansberg Shooter
Demmler 103EO w/feeder skip hoist semi-auto cycle
Ross Vibra—Draws
Federal San Blo Pulsator, Model L40P1LPP
B&P Flexiblo, Model No. CB-10-DH w/ Universal Blo Plate

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Tower oven, various sizes
Batch type, core & mold drying, various sizes
Porbeck 16-2B double and single end five drawer
Foundry Equipment, single end, 5 drawer
Porbeck C3C Double End and Single End, Oil Fired

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Whiting No. 7 with Whiting No. 7 Inclined Skip Dump Charger, Spencer Turbo Centrifugal Blower 75 HP, Foxboro Air Weight Controller, Syntron Alloy Feeder, all new 1957, excellent.

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#60 to #250 Crucible & Iron Pot Furnaces, stationary and tilt
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6000# Fisher Simplex reverberatory complete, gas fired
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CLEANING EQUIPMENT

48 x 72 American Wheelabrator with skip and dust collector.

48 x 48 American Wheelabrator w/skip hoist
42 x 48 American Wheelabrator
36 x 42 American Wheelabrator with skip & dust collector
27 x 36 American Wheelabrator with skip & dust collector
20 x 20 Air Blast Sly Barrel
36 x 72 Sly Tumbling Barrel, gearmotor drive
American 66" swing table
Pangborn LG 14, 6' table blast

GRINDERS
Marschke 2 x 24
U. S. No. 65, variable speed 24"
Gardner 54" surface grinder
Gardner 36" opposed wheel surface grinder

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100 HP XRB Ingersoll-Rand 2 stage, horizontal
175 HP XRE 2 stage, synchronous motor
30 HP Ingersoll-Rand horizontal
Gardner-Denver 15 HP, water cooled
Gardner-Denver class WB Vertical water cooled, direct connect 50 H.P. motor, 285 CFM

AIR HOISTS
Ingersoll-Rand 700#, 1000#, 2000#, 4000# and 10,000#
Curtis Air Cylinder Hoists

ELECTRIC HOISTS
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Comet 500#
Cleveland 1000#
Yale 1000#, 6000#
Budgit 1000#

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Clamshell Buckets ¾ & 1 Yard
39" Magnet
45" Bolted ECM Magnet
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130' of 30" roller conveyor, 3½ rollers, 6" centers, 4" channels

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Detroit HB1 Brinell Hardness Tester
Sand Testing Equipment

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Niles Radial Drill 13" x 5' arm
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Tabor cutoff saw 7½ HP
Tessmer, Obermayer, Perkins ¾", 1½" blades, sprue cutters
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Steel Flasks
Slip Flasks, Jackets
500# Print-O-Matic Dial

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48" x 48" WHEELABRATOR Tumblast
48" x 72" WHEELABRATOR Tumblast
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72" WHEELABRATOR Swing Table
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6' LG PANGBORN Table
9' LG PANGBORN Table
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LINK-BELT Oscillating 18" W x 31'6" L

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INTERNATIONAL SB-13
MILWAUKEE TACCONE #4-M
OSBORN #91, #192, #91-10
TACCONE #4D, 10" Draw Stroke Cyl.

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COMPLETE STOCK cloth, dry & wet types; 1000 to 30,000 CFM

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DIRECT ARC MELTING
500 lb. LECTROMELT, Top Charge
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2000 lb. HEROULT
1 Ton/hr. LECTROMELT 13,200 volt P.
1½ Ton HEROULT
7' Top charge
9' Top charge
11' Top Charge Furnace
INDIRECT ARC MELTING
10# DETROIT
350# DETROIT LFA
750# DETROIT LFY, Conical Shell
1000# DETROIT AA
3000# DETROIT C, 500 KVA
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175 KW AJAX Induction Melting Installation
Ideal for nonferrous work. With 2 lift coils. Can add standard tilt furnaces for steel.
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30 KW, ECCO Hi-freq. Vacuum Melting
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80 KW TOCCO JR, 2 Sta 9600 Cyc 140 Hp Motor
100 KW TOCCO JR, 2 Sta 9600 Cyc 175 Hp Motor
200 KW TOCCO JR, 1 Sta 3000 Cyc 310 Hp Motor
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400# FISHER, MNP
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No. 900 JC STROMAN, gas, Like new
6000# STROMAN, gas fired
20 Gas & Oil Fired Furnaces
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4' x 4' x 10' Gas Fired Annealing
210 KW LINDBERG conveyor box type
7' Rotary G.E. 200 K.W. 1950° F
36" x 36" West. Pit Type Electric
10" x 12" x 24" LINDBERG, 2500° F. Hyd
36 x 96, 48 x 120, 48 x 144 gas fired
Large Stock Gas Fired Box Heat Treating Furnaces

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42 x 96, 42 x 120 recirculating gas fired

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DOUBLE END
3 Hp HISEY WOLF 3/60/220
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7½ Hp U.S. Model 66, 3/60/440
15 Hp MARSCHKE 220 volt
25 Hp KLING 3" dia. shaft
SWING FRAME
10 Hp SAFETY 24" x 3" wheel
15 Hp MARSCHKE 3/60/220-440
15 Hp MUMMERT-DIXON

• LADLES
BOTTOM POUR
MODERN 49" x 49"
MODERN Crane Type, 60" H x 60" top
CYLINDRICAL
WHITING, 26" L x 25" dia, 1100# iron
WHITING, 19" L x 22" dia, 600# iron
WHITING, 38" L x 28" dia, 2200# iron

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BYERS Mobile Crane, BUDA Engine, 50' Boom, 5 ton w/magnet & bucket
HOUGH PAYLOADER, Model HA, 1000# cap., hyd. lift
5 Ton Crane 50'-AC w/300' "A" Frame Runway, M.G. Set-Magnet-Bucket

• MOLDING MACHINES
JOLT SQUEEZERS
INTERNATIONAL #12 LJS, 16" x 20"
OSBORN #276-J & PJ, 17" x 26" table
OSBORN #275J, 16" x 20" table, 400#
SPO 113PJ, 18½" x 26" table
SPO #110J, 17" x 20" table 400#
TABOR Squeeze-in Head, 16" x 19" table
TABOR Yoke Type, 18" x 26" table

• OVENS
ALLIS CHALMERS 20 KW, Model 750, dielectric
COLEMAN, Gas, 2 Comp. and 5 drawers, O.D. 22' x 12' x 10'
GIRDLER Thermex Dielectric Core Oven, 15KW w/36" W mesh belt
THERMONIC Dielectric Core Oven, 18 KW, w/40" wide mesh belt

• PRESSES
40 Ton FERRACUTE Sprue Cutter 1½" stroke
125 ton R.D. WOOD Down acting, 9" stroke
1000 ton Hyd. Press, bed area LR 63 x FB 60.

• SAND SLINGERS
B&P Stationary, Single Speed
B&P Tractor Type 19" Head
B&P Motive Jr., 2 speed, 19" head, 5" tip

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LIKE NEW
Completely Automatic. To be sold in Tandem or Indiv. at a Fraction of Cost. Squeeze Cyl 21" Dia. Max. Sq. Piston Stroke 12⅞" Comp w/100 sets 20" x 24" Flasks Model 360-1.
PHONE-WIRE-WRITE FOR COMPLETE DETAILS.

• MOLDING MACHINES
JOLT ROLLOVER PATTERN DRAW
DAVENPORT #40SA, 40" x 60" table
HERMAN 10,000#, 48" x 100" table
HERMAN 6000#, 42" x 78"
HERMAN 7500#, 40" x 50" table
HERMAN 3000#, 30" x 66" table
HERMAN 3000#, 32" x 70", 15" cyl. series charging conveyor type
HERMAN 1500#, 30" x 48" table
HERMAN 750#, 20" x 24" table
INTERNATIONAL 27" x 16", Type F, 22" x 64" table
INTERNATIONAL 43" x 16", type F, 42" x 72" table
INTERNATIONAL 31" x 16", Type F, 28" x 78" table
INTERNATIONAL 30" x 12", Type G, 28" x 35" table
INTERNATIONAL 13" x 17" table
J & J #610, 24" x 30" table
OSBORN #602, 36" x 26", 900#
OSBORN #444, 28" x 39" table, 1000#, port.
OSBORN #405, 3000#, flask 64" x 57"
OSBORN #243, 31" x 42"
TABOR 40" x 50" table, 3000# capacity
TABOR 22" x 42" pattern draw shockless, portable 600#
TABOR 20" x 30" w/air clamp 1000#
TABOR 14" x 16" Rockover 150#
PLAIN JOLT
INTERNATIONAL, 3' x 4' Table, 12" cyl.
TABOR 3' x 4' table
JOLT PIN LIFT
HERMAN #1317, 22" x 30" table
OSBORN #558, 21" x 24" table
OSBORN 559—25" x 30" table
SPO-307—25" x 30" table
SPO #3058, 23" x 27" table
SPO #305, 750 lb. 20" x 27" table
TABOR 20" x 24" table, 600#
JOLT SQUEEZE PIN LIFT
INTERNATIONAL PKL, 20" x 28" table, 14" sq. 5½" draw
INTERNATIONAL PKL, 18" x 24" table, 12" sq., 5½" draw, stat.
MILWAUKEE #163, 15" x 24" table, 11" sq., 1500#
NICHOLS 18-44, 6¼" draw
OSBORN #1024, 1800#, 10½" draw
OSBORN #716 PJ, 22" x 34" table 16" sq., 8" draw
OSBORN, #712J, #712PJ, 18" x 28" table, 12" sq., 6" draw, stat. & port.
SPO #2114P, 21" x 27" table, 600#
SPO #2116, 21" x 27" table, 11" sq.
SPO #2136, 21" x 30" table, 13" squeeze cyl.
SPO #2148, 23" x 31" table, 14" squeeze cyl.

• SAND CONDITIONING
B&P Nite-Gang
B&P Screenarator, Model "M"
LINK-BELT Revivifier
ROYER NB-2, 7-10 tons/hr., ¾ Hp.
ROYER PREPARATOR, Comb., Model NDC, 25 ton/hr scrap removal 5' x 8' hopper
ROYER, NDP, 15-25 tons/hr, 2 Hp
ROYER, "NRP,"40-60 tons/hr, 5 Hp.

• TESTING MACHINES
3000 Kg Gogan Brinell Testers
Detroit "Brinnell" Direct Reading Hardness Tester—Model DH-1

• MULLERS AND MIXERS
B&P No. 3½ Mulbaro, 3½ cu. ft.
B&P #30 Speedmuller w/skip, 3 cu. ft.
B&P #40 Speedmuller w/skip, 5 cu. ft.
B&P Conventional, SIMPSON type, 87½" Dia., arranged for cooling
B&P #70 Speedmuller, 15 cu. ft. w/cooling
CLEARFIELD #920, 9' dia., 30 cu. ft.
SIMPSON #1, U.D., 4' dia., 4 cu. ft.
SIMPSON #1, Sep. Dr., 4' dia., 4 cu. ft.
SIMPSON #1½, Sep. Dr., 4'6" dia., 6 cu. ft.
CLEARFIELD, 610, 6' dia., 10-14 cu. ft.
SIMPSON #3, 8' Dia. Sep. Dr. or U.D. 30 cu. ft.
WHIRLMIX 31" dia., 200 to 300 lb. sand

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2' x 10' HEWITT-ROBINS
3' x 10' SIMPLICITY
4' x 5' SIMPLICITY
4' x 6' SIMPLICITY
4' x 8' SIMPLICITY
5' x 6' HEWITT-ROBINS

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100 KVA KUHLMAN 13,200, 1/60
250 KVA WESTINGHOUSE 6600, 3/60
300 KVA WAGNER 4600, 1/60
500 KVA KUHLMAN 13,200, 1/60
800 KVA PENNA, 23,000, 3/60
1000 KVA WESTINGHOUSE 23,000, 3/60
2000 KVA WESTINGHOUSE 13,200, 3/60

• MISCELLANEOUS
SLY Rd. Tumb. Bbl. 63" x 32", 45" x 36" 69" x 39"
AMERICAN "F" Rod Straightener, ⅜" to 1¼"
CLIMAX Model 2-A Wire Straightener
CRESCENT Band Saw, 32" wheels
FLASKS, CORE PLATES, All Sizes
MOULDER'S Hoppers, Various Sizes

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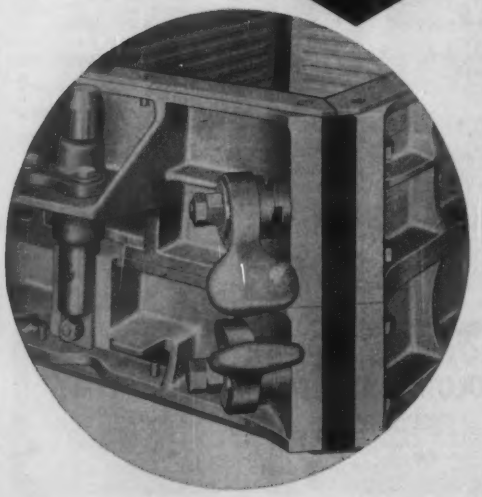

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Parts in computing devices, aircraft or missile guidance systems, and electronic equipment must be dimensionally stable, sometimes to a few millionths of an inch per inch. Two factors interfere with such dimensional stability: (1) locked-up stresses and (2) growth. While there are many approaches to the solution of this problem, most involve a lot of time and trouble, but contribute little to stability of parts.

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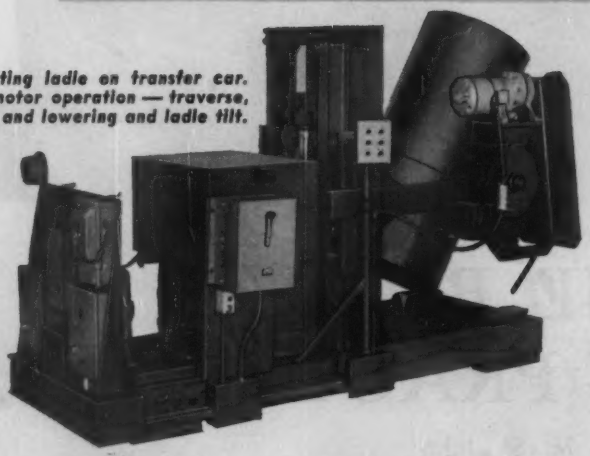

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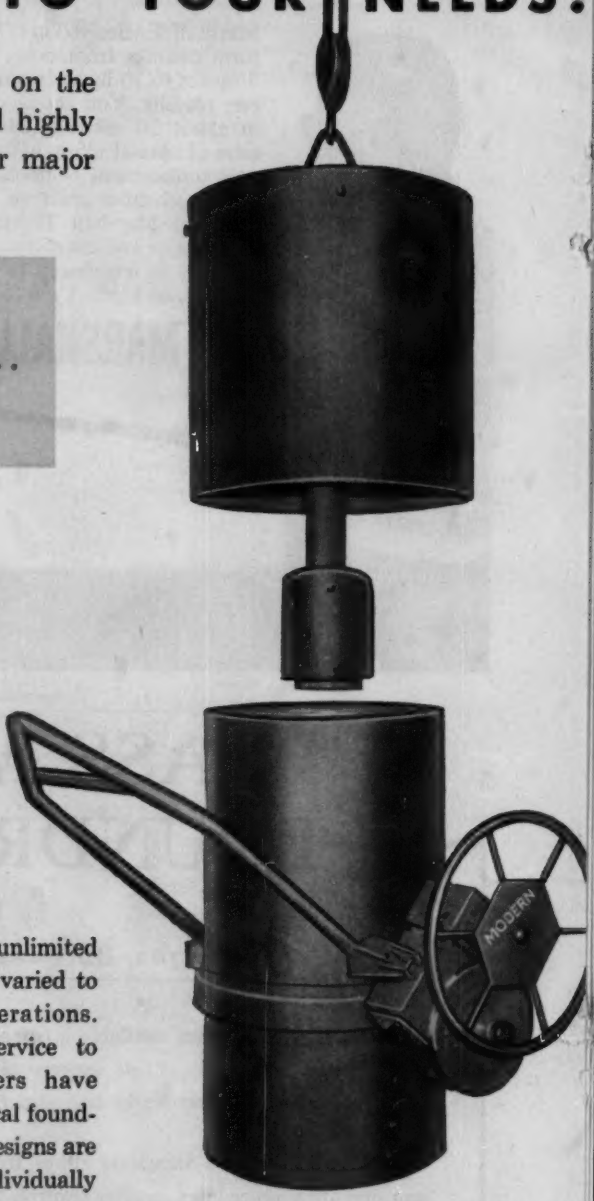

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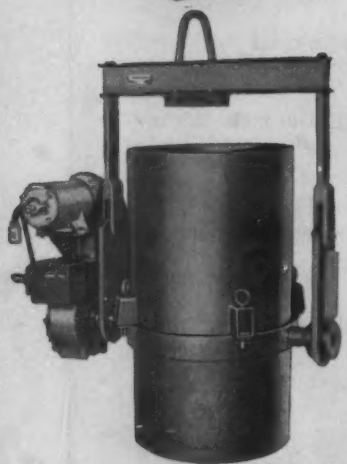

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